IDSS, Intelligent Decision Support System

The following requirements must be met on both the server and the client to support the basic installation and use of WebSphere Application Server, Version 5.0.1 and WebSphere Application Server, Version 5.0.1, Enterprise

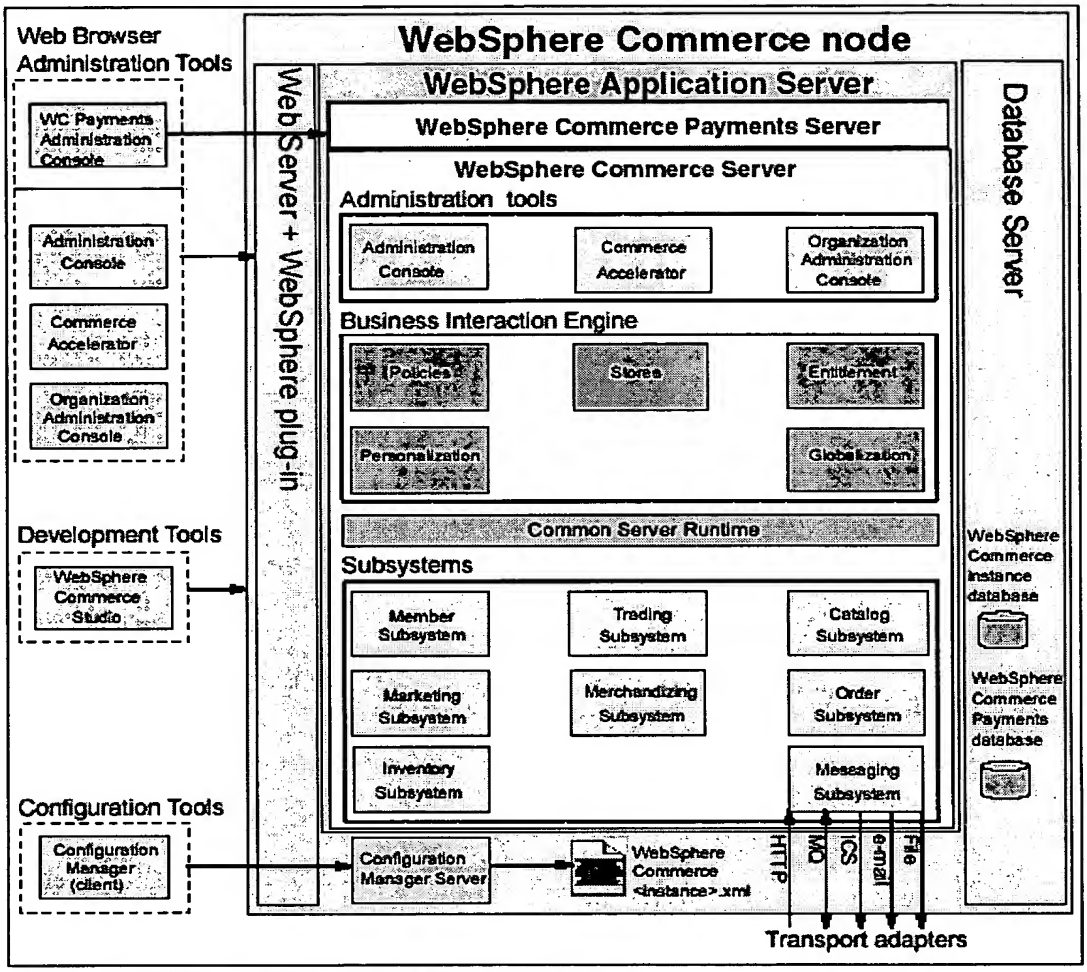


Figure 1 WebSphere Commerce Server runtime components

For AIX on pSeries:

Hardware

RS/6000 Workstation or RS/6000 SP Frame at 375 MHz or faster
Minimum 512 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

AIX, Version 4.3.3.7
Netscape Navigator, Version 4.7.3
Web browser that supports HTML 4 and CSS

For OS/400 on iSeries:

Hardware

iSeries systems at 500 CPW or higher
Minimum of 600 MB of Disk for Installation (includes SDK)
Minimum of 512 MB of Memory; 768 MB Recommended
CD-ROM Drive

Software

OS/400 Version 5 Release 1 or Version 5 Release 2
Netscape Navigator, Version 4.7.6
Web browser that support HTML 4 and CSS

For Linux on zSeries:

Hardware

G5, G6 or better Processor
Minimum 512 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

zSeries server Linux SuSE 7.0 or Red Hat Linux 7.2 based on Kernel 2.4
Netscape Navigator, Version 4.7.6
Web browser that support HTML 4 and CSS

For Linux on Intel:

Hardware

Intel x86 Processor at 500 MHz or faster
Minimum 300 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

Linux Red Hat 7.1 or Linux SuSE 7.1 Linux based on Kernel 2.4
Netscape Navigator, Version 4.7.6
Web browser that support HTML 4 and CSS

For HP:

Hardware

HP 9000 at 440 MHz or faster
Minimum 552 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

HP-UX, Version 11.0
Netscape Navigator, Version 4.7.3
Web browser that supports HTML 4 and CSS

For Sun Solaris:

Hardware

Sun SPARC Workstation at 440 MHz, or faster
Minimum 532 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

Solaris, Version 7 or Version 8 or higher
Netscape Navigator, Version 4.7.3
Web browser that support HTML 4 and CSS

For Windows NT or Windows 2000 or Windows XP:

Hardware

Intel Pentium Processor at 500 MHz, or faster
Minimum 520 MB Free Disk Space for Installation (includes SDK)
Minimum 256 MB of Memory; 512 MB Recommended
CD-ROM Drive

Software

Windows NT Server 4.0, Service Pack 6a or higher
Windows 2000 or Advanced Server Service Pack 2
Netscape Navigator, Version 4.7.3
Web browser that supports HTML 4 and CSS

1 Gen ral Information

Author:	Youngthink A.I. Labs
Created:	18 Apr 2001
Print Date:	27 Aug 2003

Edition

System Name:	Intelligent Decision Support System
Edition Name:	IRE-IDSS, Intelligent Rule-base Engine Java Edition
Genetic Module:	Genetic add-on Module installed
Neuro Module:	NeuroFuzzy add-on Module installed
Time-Series Module:	Time-Series add-on Module installed

.1 List of Abbreviations

Input Variables	
IREGCROP3	IRECR Engine Output Risk Parameter (0 ~ 1)
IREGCUOP4	IRECU Engine Output Credit Parameter (0 ~ 1)
IREGMKOP3	IREMK Engine Output Marketing Parameter (0 ~ 1)
Output Variables	
IREGCPOP1	IRECP Engine Output 1 (0 ~ 1)
IREGCPOP2	IRECP Engine Output 2 (0 ~ 1)
Compute MBF	Compute Membership Function (Fuzzification Method)
CoM	Center of Maximum (Defuzzification Method)
BSUM	Bounded Sum Fuzzy Operator for Result Aggregation
MIN	Fuzzy Operator for AND Aggregation
MAX	Fuzzy Operator for OR Aggregation
GAMMA	Compensatory Operator for Aggregation
PROD	Fuzzy Operator for Composition
LV	Linguistic Variable
MBF	Membership Function
RB	Rule Block

2 Intelligent D cision Support System

.1 Project Description

Edition Name: IRE-IDSS, Intelligent Rule-base Engine Java Edition
System Name: Intelligent Decision Support System

Input Variables	3
Output Variables	2
Intermediate Variables	0
Rule Blocks	2
Rules	200
Membership Functions	50

Table 1: Project Statistics

.2 System Structure

The system structure identifies the fuzzy logic inference flow from the input variables to the output variables. The fuzzification in the input interfaces translates analog inputs into fuzzy values. The fuzzy inference takes place in rule blocks which contain the linguistic control rules. The output of these rule blocks are linguistic variables. The defuzzification in the output interfaces translates them into analog variables.

The following figure shows the whole structure of this fuzzy system including input interfaces, rule blocks and output interfaces. The connecting lines symbolize the data flow.

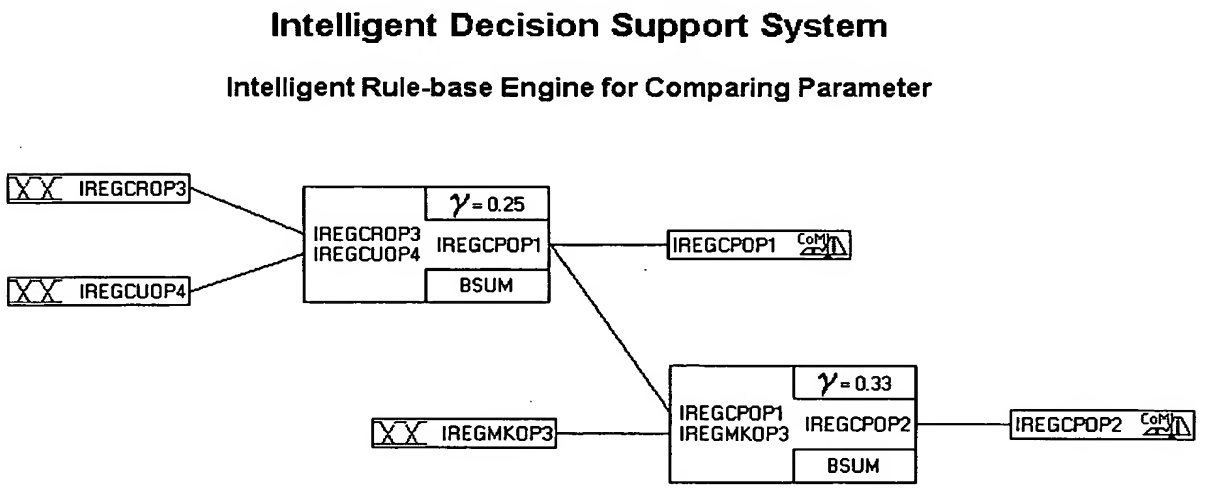


Figure 1: Structure of the Fuzzy Logic System

.3 Linguistic Variabl s

This chapter contains the definition of all linguistic variables and of all membership functions.
Linguistic variables are used to translate real values into linguistic values. The possible values of a linguistic variable are not numbers but so called 'linguistic terms'.

The following table lists all linguistic variables of the system as well as the respective fuzzification or defuzzification method. Also the properties of all base variables and the term names are listed.

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
1	IREGCROP3		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
2	IREGCUOP4		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
3	IREGMKOP3		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
4	IREGCPOP1		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
5	IREGCPOP2		Units	0	1	0	term1 term2

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
							term3
							term4
							term5
							term6
							term7
							term8
							term9
							term10

Table 2: Linguistic Variables

	Compute MBF		Center of Maximum (CoM)
	Look up MBF		Mean of Maximum (MoM)
	Categorical Variables		Center of Area (CoA)
	Display		Hyper CoM
	Fuzzy Input/Fuzzy Output		Force

The default value of an output variable is used if no rule is firing for this variable. Different methods can be used for the defuzzification, resulting either into the 'most plausible result' or the 'best compromise'.

The 'best compromise' is produced by the methods:

CoM (Center of Maximum)
CoA (Center of Area)
CoA BSUM, a version especially for efficient VLSI implementations

The 'most plausible result is produced by the methods:

MoM (Mean of Maximum)
MoM BSUM, a version especially for efficient VLSI implementations

.1 Input Variable "IREGCROP3"

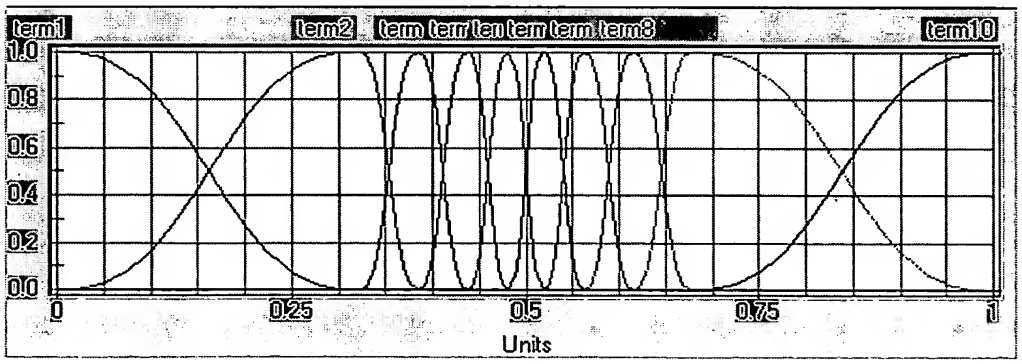


Figure 2: MBF of "IREGCROP3"

Term Name	Shape/Par.	Definiti	n P	ints (x, y)	
term1	S-Shape/0.50	(0, 1)		(0.32284, 0)	(1, 0)
term2	S-Shape/0.50	(0, 0)		(0.32284, 1)	(0.38456, 0)

Term Name	Shape/Par.	Definiti n P ints (x, y)		
		(1, 0)		
term3	S-Shape/0.50	(0, 0)	(0.32284, 0)	(0.38456, 1)
		(0.43688, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.38456, 0)	(0.43688, 1)
		(0.4812, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.43688, 0)	(0.4812, 1)
		(0.51878, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.4812, 0)	(0.51878, 1)
		(0.5631, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.51878, 0)	(0.5631, 1)
		(0.61542, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.5631, 0)	(0.61542, 1)
		(0.67714, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.61542, 0)	(0.67714, 1)
		(1, 0)		
term10	S-Shape/0.50	(0, 0)	(0.67714, 0)	(1, 1)

Table 3: Definition Points of MBF "IREGCROP3"

.2 Input Variable "IREGCUOP4"

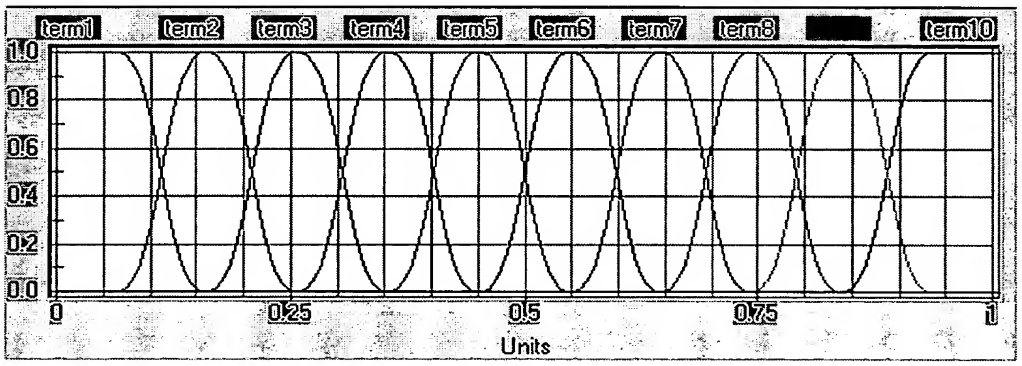


Figure 3: MBF of "IREGCUOP4"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)

Term Name	Shape/Par.	Definiti n P ints (x, y)		
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 4: Definition Points of MBF "IREGCUOP4"

.3 Input Variable "IREGMKOP3"

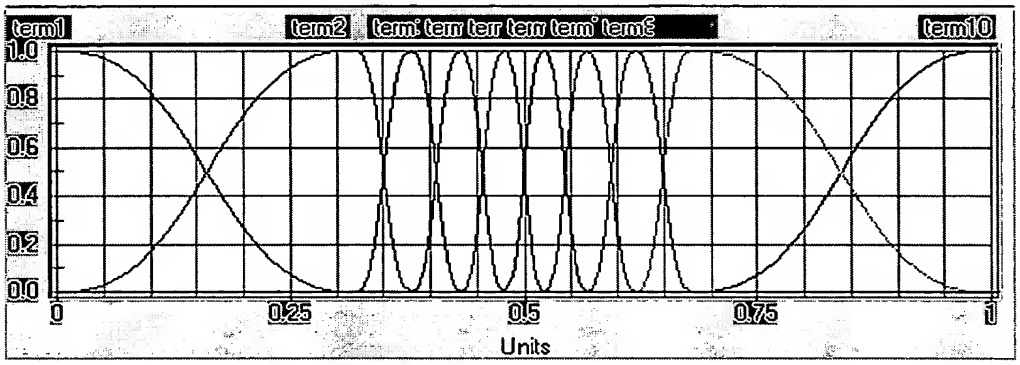


Figure 4: MBF of "IREGMKOP3"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.32004, 0)	(1, 0)
term2	S-Shape/0.50	(0, 0)	(0.32004, 1)	(0.38094, 0)
		(1, 0)		
term3	S-Shape/0.50	(0, 0)	(0.32004, 0)	(0.38094, 1)
		(0.4339, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.38094, 0)	(0.4339, 1)
		(0.47998, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.4339, 0)	(0.47998, 1)
		(0.52002, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.47998, 0)	(0.52002, 1)
		(0.56608, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.52002, 0)	(0.56608, 1)
		(0.61904, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.56608, 0)	(0.61904, 1)
		(0.67994, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.61904, 0)	(0.67994, 1)
		(1, 0)		
term10	S-Shape/0.50	(0, 0)	(0.67994, 0)	(1, 1)

Table 5: Definition Points of MBF "IREGMKOP3"

.4 Output Variable "IREGCPOP1"

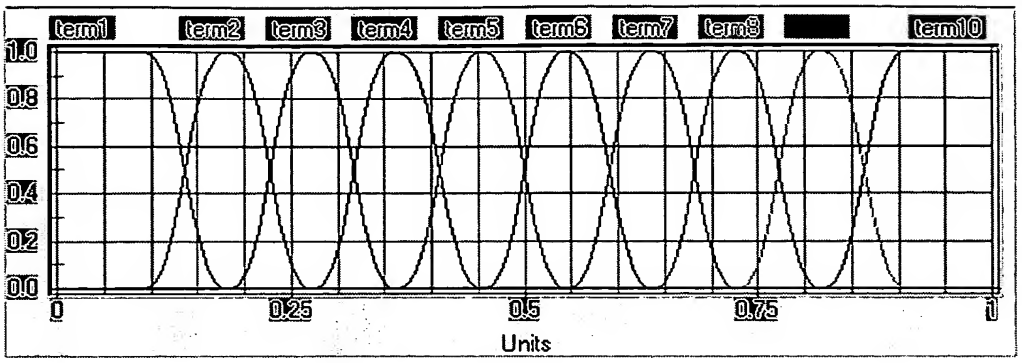


Figure 5: MBF of "IREGCPOP1"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.0909, 1)	(0.18182, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.0909, 0)	(0.18182, 1)
		(0.27272, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.18182, 0)	(0.27272, 1)
		(0.36362, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.27272, 0)	(0.36362, 1)
		(0.45454, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.36362, 0)	(0.45454, 1)
		(0.54544, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45454, 0)	(0.54544, 1)
		(0.63636, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54544, 0)	(0.63636, 1)
		(0.72726, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.63636, 0)	(0.72726, 1)
		(0.81818, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.72726, 0)	(0.81818, 1)
		(0.90908, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.81818, 0)	(0.90908, 1)
		(1, 1)		

Table 6: Definition Points of MBF "IREGCPOP1"

.5 Output Variable "IREGCPOP2"

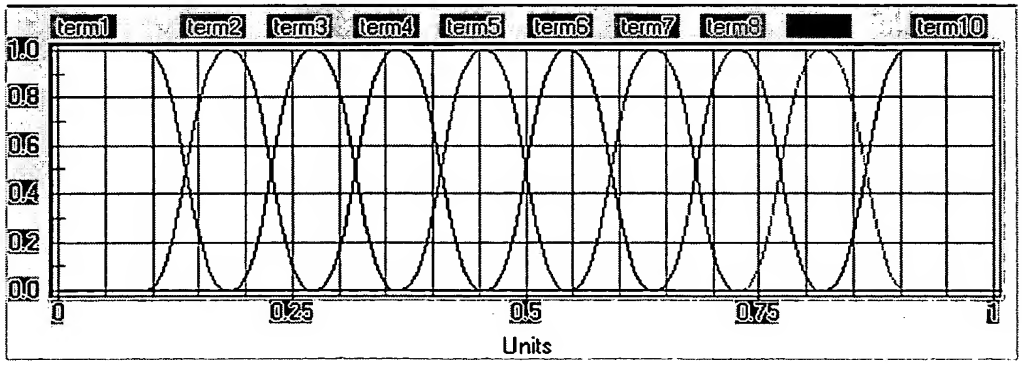


Figure 6: MBF of "IREGCPOP2"

Term Name	Shape/Par.	Definition P	ints (x, y)	
term1	S-Shape/0.50	(0, 1)	(0.0909, 1)	(0.18182, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.0909, 0)	(0.18182, 1)
		(0.27272, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.18182, 0)	(0.27272, 1)
		(0.36362, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.27272, 0)	(0.36362, 1)
		(0.45454, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.36362, 0)	(0.45454, 1)
		(0.54544, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45454, 0)	(0.54544, 1)
		(0.63636, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54544, 0)	(0.63636, 1)
		(0.72726, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.63636, 0)	(0.72726, 1)
		(0.81818, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.72726, 0)	(0.81818, 1)
		(0.90908, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.81818, 0)	(0.90908, 1)
		(1, 1)		

Table 7: Definition Points of MBF "IREGCPOP2"

.4 Rule Blocks

The rule blocks contain the control strategy of a fuzzy logic system. Each rule block confines all rules for the same context. A context is defined by the same input and output variables of the rules.

The rules' 'if' part describes the situation, for which the rules are designed. The 'then' part describes the response of the fuzzy system in this situation. The degree of support (DoS) is used to weigh each rule according to its importance.

The processing of the rules starts with calculating the 'if' part. The operator type of the rule block determines which method is used. The operator types MIN-MAX, MIN-AVG and GAMMA are available. The characteristic of each operator type is influenced by an additional parameter.

For example:

MIN-MAX, parameter value 0 = Minimum Operator (MIN)
MIN-MAX, parameter value 1 = Maximum Operator (MAX)
GAMMA, parameter value 0 = Product Operator (PROD)

The minimum operator is a generalization of the Boolean 'and'; the maximum operator is a generalization of the Boolean 'or'.

The fuzzy composition eventually combines the different rules to one conclusion. If the BSUM method is used all firing rules are evaluated, if the MAX method is used only the dominant rules are evaluated.

.1 Rule Block "RB1"

IRECP Engine 1

Parameter

Aggregation:	GAMMA
Parameter:	0.25
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN	
IREGCROP3	**IREGCUOP4**	**DoS**	**IREGCPOP1**
term1	term1		
term1	term2		
term1	term3		
term1	term4		
term1	term5		
term1	term6		
term1	term7		
term1	term8		
term1	term9		
term1	term10		
term2	term1		
term2	term2		
term2	term3		
term2	term4		
term2	term5		
term2	term6		
term2	term7		
term2	term8		
term2	term9		
term2	term10		
term3	term1		
term3	term2		
term3	term3		
term3	term4		
term3	term5		
term3	term6		
term3	term7		
term3	term8		
term3	term9		
term3	term10		
term4	term1		
term4	term2		
term4	term3		
term4	term4		
term4	term5		
term4	term6		
term4	term7		

	IF	THEN
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	

	IF	THEN
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 8: Rules of the Rule Block "RB1"

.2 Rule Block "RB2"

IRECP Engine 2

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

	IF	THEN
IREGCPOP1	**IREGMKOP3**	**DoS IREGCPOP2**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	

	IF	THEN
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	

IF		THEN
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 9: Rules of the Rule Block "RB2"

1 General Information

Author:	Youngthink A.I. Labs
Created:	18 Apr 2001
Print Date:	27 Aug 2003

Edition

System Name:	Intelligent Decision Support System
Edition Name:	IRE-IDSS, Intelligent Rule-base Engine Java Edition
Genetic Module:	Genetic add-on Module installed
Neuro Module:	NeuroFuzzy add-on Module installed
Time-Series Module:	Time-Series add-on Module installed

.1 List of Abbreviations

Input Variables	
CACRCRAM	Card Amount (0 ~ 30)
CACRDEDY	Term of Payment Delay (0 ~ 10)
CACRDEQC	Frequency of Payment Delay (0 ~ 180)
EGPRRKCO	IRE Risk Behavior Parameter (0 ~ 1)
Output Variables	
IREGCROP1	IRE Card Engine Output 1 (0 ~ 1)
IREGCROP2	IRE Card Engine Output 2 (0 ~ 1)
IREGCROP3	IRE Card Engine Output 3 (0 ~ 1)
Compute MBF	Compute Membership Function (Fuzzification Method)
CoM	Center of Maximum (Defuzzification Method)
BSUM	Bounded Sum Fuzzy Operator for Result Aggregation
MIN	Fuzzy Operator for AND Aggregation
MAX	Fuzzy Operator for OR Aggregation
GAMMA	Compensatory Operator for Aggregation
PROD	Fuzzy Operator for Composition
LV	Linguistic Variable
MBF	Membership Function
RB	Rule Block

2 Intellig nt D cision Support System

.1 Project Description

Edition Name: IRE-IDSS, Intelligent Rule-base Engine Java Edition
System Name: Intelligent Decision Support System

Input Variables	4
Output Variables	3
Intermediate Variables	0
Rule Blocks	3
Rules	220
Membership Functions	62

Table 1: Project Statistics

.2 System Structure

The system structure identifies the fuzzy logic inference flow from the input variables to the output variables. The fuzzification in the input interfaces translates analog inputs into fuzzy values. The fuzzy inference takes place in rule blocks which contain the linguistic control rules. The output of these rule blocks are linguistic variables. The defuzzification in the output interfaces translates them into analog variables.

The following figure shows the whole structure of this fuzzy system including input interfaces, rule blocks and output interfaces. The connecting lines symbolize the data flow.

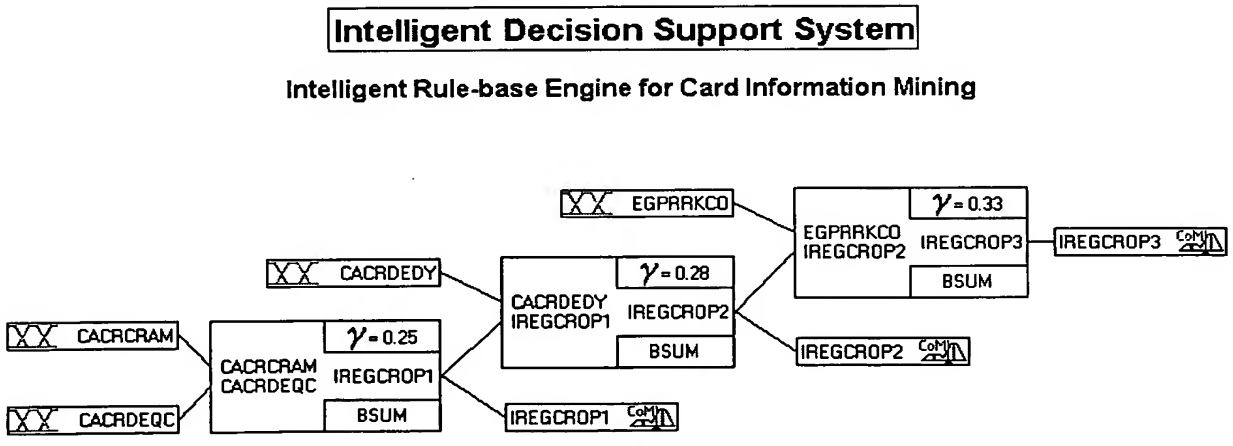


Figure 1: Structure of the Fuzzy Logic System

.3 Linguistic Variabl s

This chapter contains the definition of all linguistic variables and of all membership functions.
Linguistic variables are used to translate real values into linguistic values. The possible values of a linguistic variable are not numbers but so called 'linguistic terms'.

The following table lists all linguistic variables of the system as well as the respective fuzzification or defuzzification method. Also the properties of all base variables and the term names are listed.

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
1	CACRCRAM		Units	0	30	1	very low low medium low medium medium high high very high
2	CACRDEDY		Units	0	10	0	very low low medium high very high
3	CACRDEQC		Units	0	180	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
4	EGPRRKCO		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
5	IREGCROP1	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
6	IREGCROP2	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
7	IREGCROP3	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10

Table 2: Linguistic Variables

	Compute MBF	CoM	Center of Maximum (CoM)
	Look up MBF	MoM	Mean of Maximum (MoM)
	Categorical Variables	CoA	Center of Area (CoA)
	Display		Hyper CoM
	Fuzzy Input/Fuzzy Output		Force

The default value of an output variable is used if no rule is firing for this variable. Different methods can be used for the defuzzification, resulting either into the 'most plausible result' or the 'best compromise'.

The 'best compromise' is produced by the methods:

CoM (Center of Maximum)
CoA (Center of Area)
CoA BSUM, a version especially for efficient VLSI implementations

The 'most plausible result is produced by the methods:

MoM (Mean of Maximum)
MoM BSUM, a version especially for efficient VLSI implementations

.1 Input Variable "CACRCRAM"

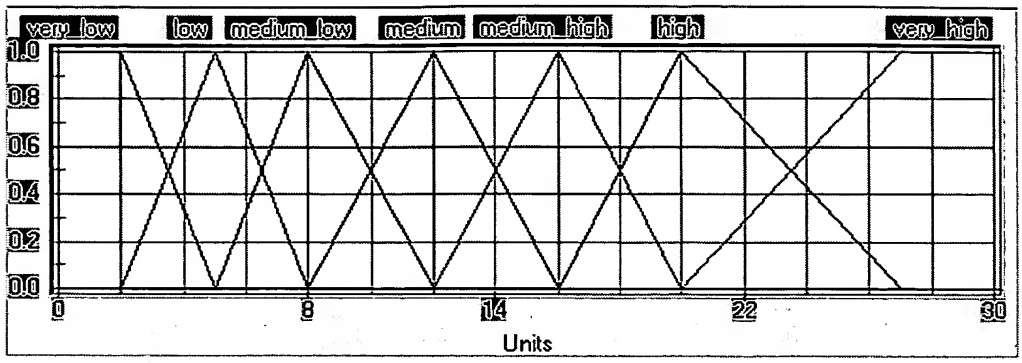


Figure 2: MBF of "CACRCRAM"

Term Name	Shape/Par.	Definition Points (x, y)		
very low	linear	(0, 1)	(2, 1)	(5, 0)
		(30, 0)		
low	linear	(0, 0)	(2, 0)	(5, 1)
		(8, 0)	(30, 0)	
medium low	linear	(0, 0)	(5, 0)	(8, 1)
		(12, 0)	(30, 0)	
medium	linear	(0, 0)	(8, 0)	(12, 1)
		(16, 0)	(30, 0)	
medium high	linear	(0, 0)	(12, 0)	(16, 1)
		(20, 0)	(30, 0)	
high	linear	(0, 0)	(16, 0)	(20, 1)
		(27, 0)	(30, 0)	
very high	linear	(0, 0)	(20, 0)	(27, 1)
		(30, 1)		

Table 3: Definition Points of MBF "CACRCRAM"

.2 Input Variable "CACRDEDY"

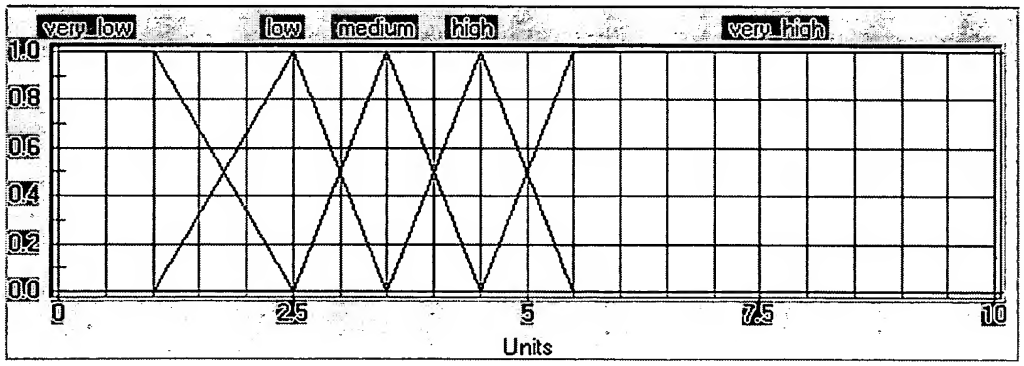


Figure 3: MBF of "CACRDEDY"

Term Name	Shape/Par.	Definition P ints (x, y)		
very low	linear	(0, 1)	(1, 1)	(2.5, 0)
		(10, 0)		

Term Name	Shape/Par.	Definiti n P ints (x, y)		
low	linear	(0, 0)	(1, 0)	(2.5, 1)
		(3.5, 0)	(10, 0)	
medium	linear	(0, 0)	(2.5, 0)	(3.5, 1)
		(4.5, 0)	(10, 0)	
high	linear	(0, 0)	(3.5, 0)	(4.5, 1)
		(5.5, 0)	(10, 0)	
very high	linear	(0, 0)	(4.5, 0)	(5.5, 1)
		(10, 1)		

Table 4: Definition Points of MBF "CACRDEDY"

.3 Input Variable "CACRDEQC"

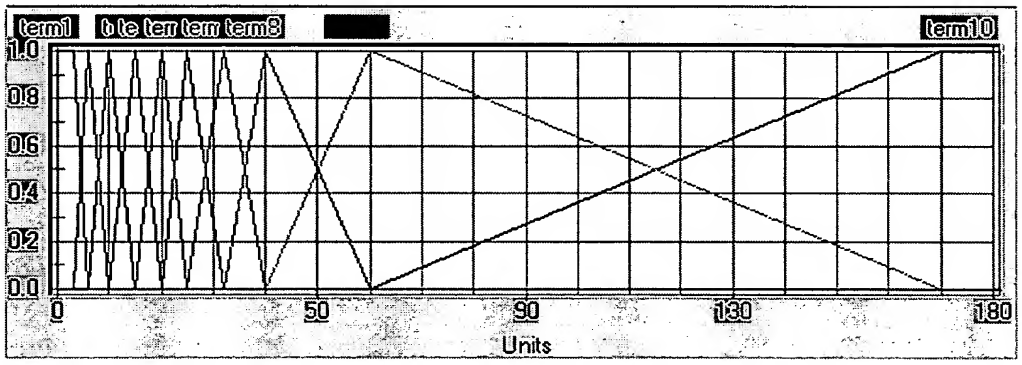


Figure 4: MBF of "CACRDEQC"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(3, 1)	(6, 0)
		(180, 0)		
term2	linear	(0, 0)	(3, 0)	(6, 1)
		(10, 0)	(180, 0)	
term3	linear	(0, 0)	(6, 0)	(10, 1)
		(15, 0)	(180, 0)	
term4	linear	(0, 0)	(10, 0)	(15, 1)
		(20, 0)	(180, 0)	
term5	linear	(0, 0)	(15, 0)	(20, 1)
		(25, 0)	(180, 0)	
term6	linear	(0, 0)	(20, 0)	(25, 1)
		(32, 0)	(180, 0)	
term7	linear	(0, 0)	(25, 0)	(32, 1)
		(40, 0)	(180, 0)	
term8	linear	(0, 0)	(32, 0)	(40, 1)
		(60, 0)	(180, 0)	
term9	linear	(0, 0)	(40, 0)	(60, 1)
		(170, 0)	(180, 0)	
term10	linear	(0, 0)	(60, 0)	(170, 1)
		(180, 1)		

Table 5: Definition Points of MBF "CACRDEQC"

.4 Input Variable "EGPRRKCO"

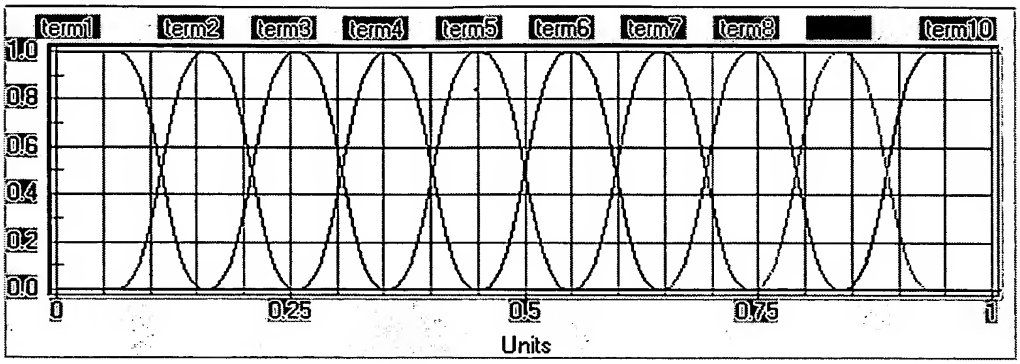


Figure 5: MBF of "EGPRRKCO"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 6: Definition Points of MBF "EGPRRKCO"

.5 Output Variable "IREGCROP1"

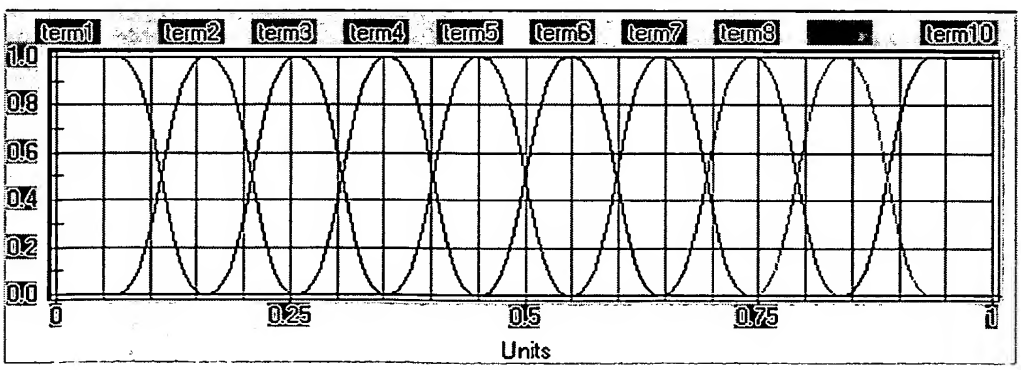


Figure 6: MBF of "IREGCROP1"

Term Name	Shape/Par.	D finiti n P ints (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 7: Definition Points of MBF "IREGCROP1"

.6 Output Variable "IREGCROP2"

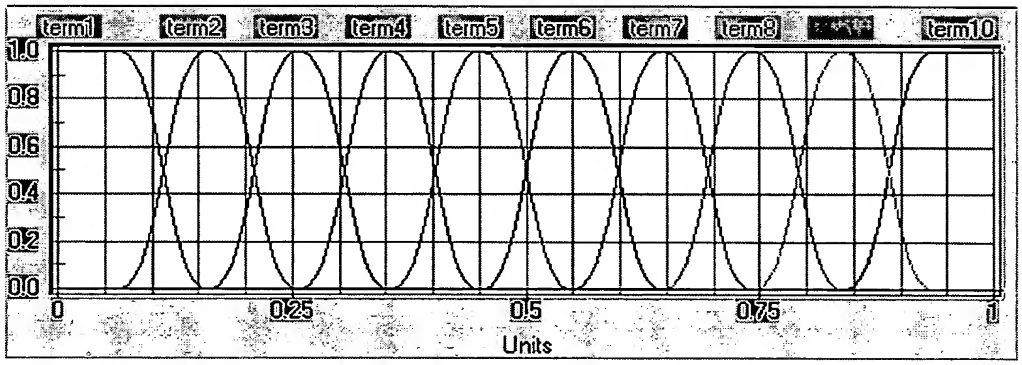


Figure 7: MBF of "IREGCROP2"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)

Term Name	Shape/Par.	Definiti n P ints (x, y)		
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 8: Definition Points of MBF "IREGCROP2"

.7 Output Variable "IREGCROP3"

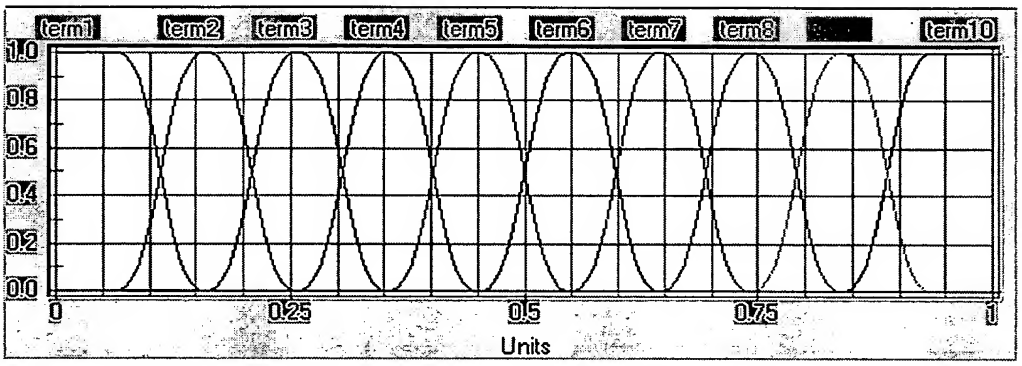


Figure 8: MBF of "IREGCROP3"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 9: Definition Points of MBF "IREGCROP3"

.4 Rule Blocks

The rule blocks contain the control strategy of a fuzzy logic system. Each rule block confines all rules for the same context. A context is defined by the same input and output variables of the rules.

The rules' 'if' part describes the situation, for which the rules are designed. The 'then' part describes the response of the fuzzy system in this situation. The degree of support (DoS) is used to weigh each rule according to its importance.

The processing of the rules starts with calculating the 'if' part. The operator type of the rule block determines which method is used. The operator types MIN-MAX, MIN-AVG and GAMMA are available. The characteristic of each operator type is influenced by an additional parameter.

For example:

MIN-MAX, parameter value 0	=	Minimum Operator (MIN)
MIN-MAX, parameter value 1	=	Maximum Operator (MAX)
GAMMA, parameter value 0	=	Product Operator (PROD)

The minimum operator is a generalization of the Boolean 'and'; the maximum operator is a generalization of the Boolean 'or'.

The fuzzy composition eventually combines the different rules to one conclusion. If the BSUM method is used all firing rules are evaluated, if the MAX method is used only the dominant rules are evaluated.

.1 Rule Block "RB1"

IRECR Engine 1

Parameter

Aggregation:	GAMMA
Parameter:	0.25
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	70

IF		THEN		
CACRCRAM	**CACRDEQC**	**D**	**S**	**IREGCROP1**
very low	term1			
very low	term2			
very low	term3			
very low	term4			
very low	term5			

	IF	THEN
very low	term6	
very low	term7	
very low	term8	
very low	term9	
very low	term10	
low	term1	
low	term2	
low	term3	
low	term4	
low	term5	
low	term6	
low	term7	
low	term8	
low	term9	
low	term10	
medium low	term1	
medium low	term2	
medium low	term3	
medium low	term4	
medium low	term5	
medium low	term6	
medium low	term7	
medium low	term8	
medium low	term9	
medium low	term10	
medium	term1	
medium	term2	
medium	term3	
medium	term4	
medium	term5	
medium	term6	
medium	term7	
medium	term8	
medium	term9	
medium	term10	
medium high	term1	
medium high	term2	
medium high	term3	
medium high	term4	
medium high	term5	
medium high	term6	
medium high	term7	
medium high	term8	
medium high	term9	
medium high	term10	
high	term1	
high	term2	
high	term3	
high	term4	
high	term5	
high	term6	
high	term7	
high	term8	
high	term9	
high	term10	
very high	term1	
very high	term2	

	IF	THEN
very high	term3	
very high	term4	
very high	term5	
very high	term6	
very high	term7	
very high	term8	
very high	term9	
very high	term10	

Table 10: Rules of the Rule Block "RB1"

.2 Rule Block "RB2"

IRECR Engine 2

Parameter

Aggregation:	GAMMA
Parameter:	0.28
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	50

	IF	THEN	
CACRDEDY	**IREGCROP1**	**DoS**	**IREGCROP2**
very low	term1		
very low	term2		
very low	term3		
very low	term4		
very low	term5		
very low	term6		
very low	term7		
very low	term8		
very low	term9		
very low	term10		
low	term1		
low	term2		
low	term3		
low	term4		
low	term5		
low	term6		
low	term7		
low	term8		
low	term9		
low	term10		
medium	term1		
medium	term2		
medium	term3		
medium	term4		
medium	term5		
medium	term6		
medium	term7		
medium	term8		

	IF	THEN
medium	term9	
medium	term10	
high	term1	
high	term2	
high	term3	
high	term4	
high	term5	
high	term6	
high	term7	
high	term8	
high	term9	
high	term10	
very high	term1	
very high	term2	
very high	term3	
very high	term4	
very high	term5	
very high	term6	
very high	term7	
very high	term8	
very high	term9	
very high	term10	

Table 11: Rules of the Rule Block "RB2"

.3 .Rule Block "RB3"

IRECR Engine 3

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

	IF	THEN	
EGPRRKCO	**IREGCROP2**	**DoS**	**IREGCROP3**
term1	term1		
term1	term2		
term1	term3		
term1	term4		
term1	term5		
term1	term6		
term1	term7		
term1	term8		
term1	term9		
term1	term10		
term2	term1		
term2	term2		
term2	term3		
term2	term4		

	IF	THEN
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	

	IF	THEN
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 12: Rules of the Rule Block "RB3"

1 General Information

Author:	Youngthink A.I. Labs
Created:	18 Apr 2001
Print Date:	27 Aug 2003

Edition

System Name:	Intelligent Decision Support System
Edition Name:	IRE-IDSS, Intelligent Rule-base Engine Java Edition
Genetic Module:	Genetic add-on Module installed
Neuro Module:	NeuroFuzzy add-on Module installed
Time-Series Module:	Time-Series add-on Module installed

.1 List of Abbreviations

Input Variables	
CACUCAGE	Cardholder's Age (18 ~ 99)
CACUCLMT	Cardholder's Credit Limit (0 ~ 5,000,000)
CACUOCCC	Cardholder's Occupation (0 ~ 6)
CACUSARY	Cardholder's Annual Salary (0 ~ 9,990,000)
EGPRCTCO	IRE Credit Behavior Parameter (0 ~ 1)
Output Variables	
IREGCUOP1	IRE Engine Output 1 (0 ~ 1)
IREGCUOP2	IRE Engine Output 2 (0 ~ 1)
IREGCUOP3	IRE Engine Output 3 (0 ~ 1)
IREGCUOP4	IRE Engine Output 4 (0 ~ 1)
Compute MBF	Compute Membership Function (Fuzzification Method)
CoM	Center of Maximum (Defuzzification Method)
BSUM	Bounded Sum Fuzzy Operator for Result Aggregation
MIN	Fuzzy Operator for AND Aggregation
MAX	Fuzzy Operator for OR Aggregation
GAMMA	Compensatory Operator for Aggregation
PROD	Fuzzy Operator for Composition
LV	Linguistic Variable
MBF	Membership Function
RB	Rule Block

2 Intelligent Decision Support Syst m

.1 Project Description

Edition Name: IRE-IDSS, Intelligent Rule-base Engine Java Edition
System Name: Intelligent Decision Support System

Input Variables	5
Output Variables	4
Intermediate Variables	0
Rule Blocks	4
Rules	350
Membership Functions	85

Table 1: Project Statistics

.2 System Structure

The system structure identifies the fuzzy logic inference flow from the input variables to the output variables. The fuzzification in the input interfaces translates analog inputs into fuzzy values. The fuzzy inference takes place in rule blocks which contain the linguistic control rules. The output of these rule blocks are linguistic variables. The defuzzification in the output interfaces translates them into analog variables.

The following figure shows the whole structure of this fuzzy system including input interfaces, rule blocks and output interfaces. The connecting lines symbolize the data flow.

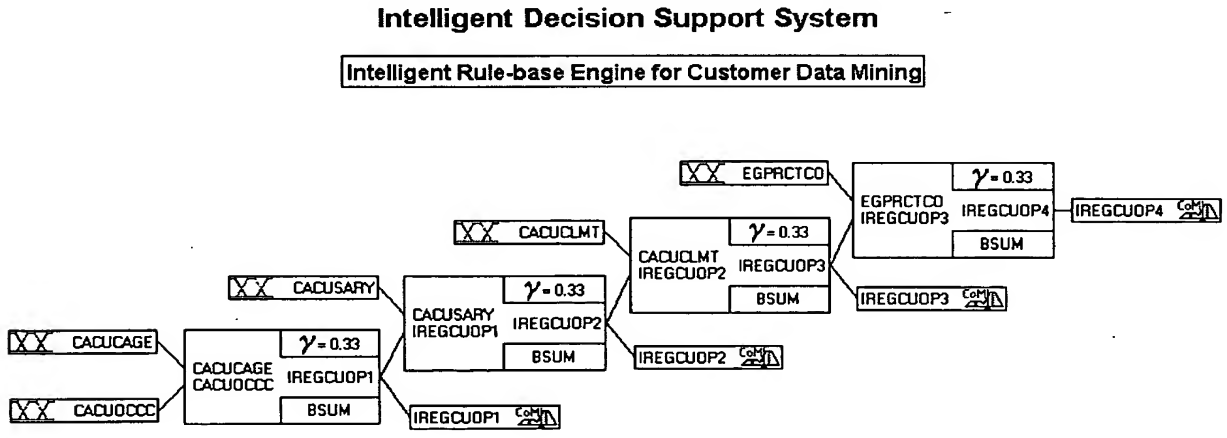


Figure 1: Structure of the Fuzzy Logic System

.3 Linguistic Variabl s

This chapter contains the definition of all linguistic variables and of all membership functions.
Linguistic variables are used to translate real values into linguistic values. The possible values of a linguistic variable are not numbers but so called 'linguistic terms'.

The following table lists all linguistic variables of the system as well as the respective fuzzification or defuzzification method. Also the properties of all base variables and the term names are listed.

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
1	CACUCAGE	XX	Ages	18	99	20	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
2	CACUCLMT	XX	NT1000	0	5000	10	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
3	CACUOCCC	XX	Units	0	6	5	very low low medium high very high
4	CACUSARY	XX	NT1000	0	9990	300	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
5	EGPRCTCO	XX	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
							term8 term9 term10
6	IREGCUOP1	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
7	IREGCUOP2	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
8	IREGCUOP3	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
9	IREGCUOP4	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10

Table 2: Linguistic Variables

The default value of an output variable is used if no rule is firing for this variable. Different methods can be used for the defuzzification, resulting either into the 'most plausible result' or the 'best compromise'.

The 'best compromise' is produced by the methods:
- CoM (Center of Maximum)
- CoA (Center of Area)
- CoA BSUM, a version especially for efficient VLSI implementations

The 'most plausible result is produced by the methods:
- MoM (Mean of Maximum)
- MoM BSUM, a version especially for efficient VLSI implementations

.1 Input Variable "CACUCAGE"

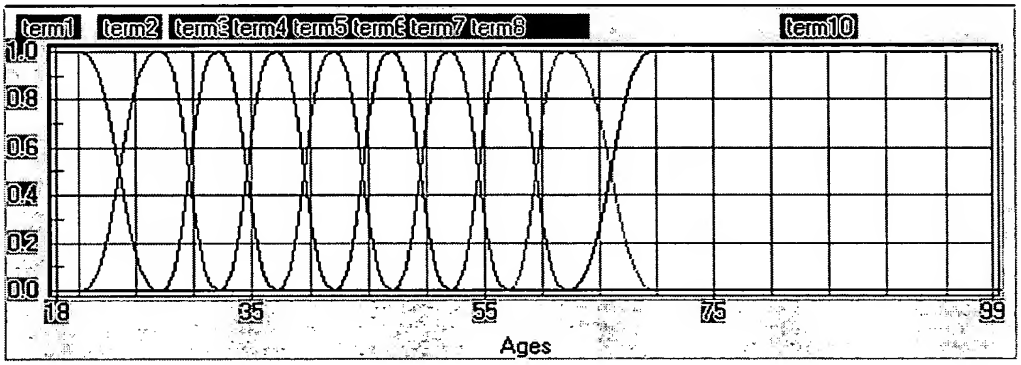


Figure 2: MBF of "CACUCAGE"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(18, 1)	(20, 1)	(27, 0)
		(99, 0)		
term2	S-Shape/0.50	(18, 0)	(20, 0)	(27, 1)
		(32, 0)	(99, 0)	
term3	S-Shape/0.50	(18, 0)	(27.0275, 0)	(32, 1)
		(37, 0)	(99, 0)	
term4	S-Shape/0.50	(18, 0)	(32, 0)	(37, 1)
		(42, 0)	(99, 0)	
term5	S-Shape/0.50	(18, 0)	(37, 0)	(42, 1)
		(47, 0)	(99, 0)	
term6	S-Shape/0.50	(18, 0)	(42, 0)	(47, 1)
		(52, 0)	(99, 0)	
term7	S-Shape/0.50	(18, 0)	(47, 0)	(52, 1)
		(57, 0)	(99, 0)	
term8	S-Shape/0.50	(18, 0)	(52, 0)	(57, 1)
		(62, 0)	(99, 0)	
term9	S-Shape/0.50	(18, 0)	(57, 0)	(62, 1)
		(70, 0)	(99, 0)	
term10	S-Shape/0.50	(18, 0)	(62, 0)	(70, 1)
		(99, 1)		

Table 3: Definition Points of MBF "CACUCAGE"

.2 Input Variable "CACUCLMT"

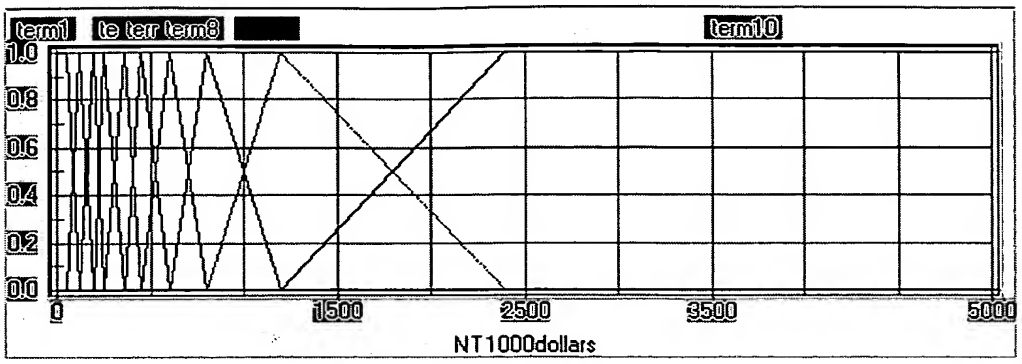


Figure 3: MBF of "CACUCLMT"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(50, 1)	(125, 0)
		(5000, 0)		
term2	linear	(0, 0)	(50, 0)	(125, 1)
		(200, 0)	(5000, 0)	
term3	linear	(0, 0)	(125, 0)	(200, 1)
		(250, 0)	(5000, 0)	
term4	linear	(0, 0)	(200, 0)	(250, 1)
		(360, 0)	(5000, 0)	
term5	linear	(0, 0)	(250, 0)	(360, 1)
		(450, 0)	(5000, 0)	
term6	linear	(0, 0)	(360, 0)	(450, 1)
		(600, 0)	(5000, 0)	
term7	linear	(0, 0)	(450, 0)	(600, 1)
		(800, 0)	(5000, 0)	
term8	linear	(0, 0)	(600, 0)	(800, 1)
		(1200, 0)	(5000, 0)	
term9	linear	(0, 0)	(800, 0)	(1200, 1)
		(2400, 0)	(5000, 0)	
term10	linear	(0, 0)	(1200, 0)	(2400, 1)
		(5000, 1)		

Table 4: Definition Points of MBF "CACUCLMT"

.3 Input Variable "CACUOCCC"

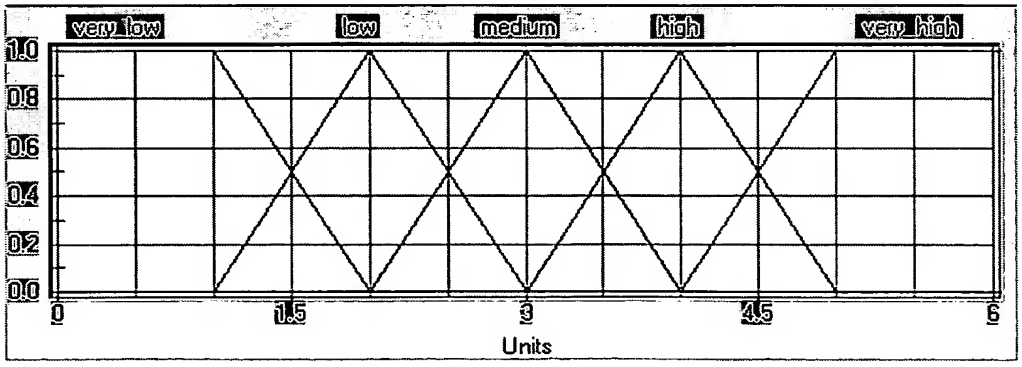


Figure 4: MBF of "CACUOCCC"

Term Name	Shape/Par.	Definiti n P ints (x, y)		
very low	linear	(0, 1)	(1, 1)	(2, 0)
		(6, 0)		
low	linear	(0, 0)	(1, 0)	(2, 1)
		(3, 0)	(6, 0)	
medium	linear	(0, 0)	(2, 0)	(3, 1)
		(4, 0)	(6, 0)	
high	linear	(0, 0)	(3, 0)	(4, 1)
		(5, 0)	(6, 0)	
very high	linear	(0, 0)	(4, 0)	(5, 1)
		(6, 1)		

Table 5: Definition Points of MBF "CACUOCCC"

.4 Input Variable "CACUSARY"

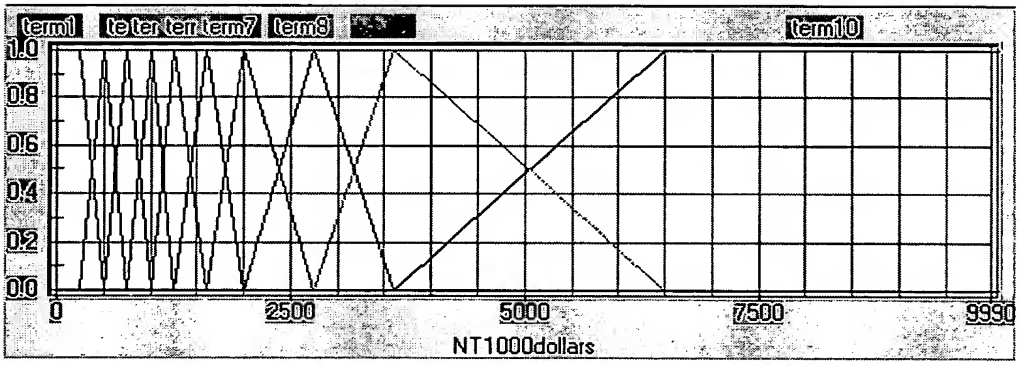


Figure 5: MBF of "CACUSARY"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(250, 1)	(500, 0)
		(9990, 0)		
term2	linear	(0, 0)	(250, 0)	(500, 1)
		(750, 0)	(9990, 0)	
term3	linear	(0, 0)	(500, 0)	(750, 1)
		(1000, 0)	(9990, 0)	
term4	linear	(0, 0)	(750, 0)	(1000, 1)
		(1250, 0)	(9990, 0)	
term5	linear	(0, 0)	(1000, 0)	(1250, 1)
		(1600, 0)	(9990, 0)	
term6	linear	(0, 0)	(1250, 0)	(1600, 1)
		(2000, 0)	(9990, 0)	
term7	linear	(0, 0)	(1600, 0)	(2000, 1)
		(2750, 0)	(9990, 0)	
term8	linear	(0, 0)	(2000, 0)	(2750, 1)
		(3600, 0)	(9990, 0)	
term9	linear	(0, 0)	(2750, 0)	(3600, 1)
		(6500, 0)	(9990, 0)	
term10	linear	(0, 0)	(3600, 0)	(6500, 1)

Term Name	Shape/Par.	Definiti n Points (x, y)
		(9990, 1)

Table 6: Definition Points of MBF "CACUSARY"

.5 Input Variable "EGPRCTCO"

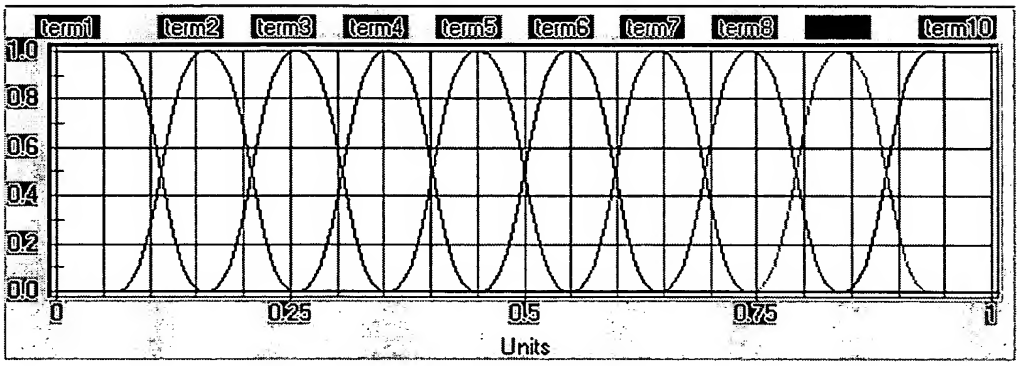


Figure 6: MBF of "EGPRCTCO"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 7: Definition Points of MBF "EGPRCTCO"

.6 Output Variable "IREGCUOP1"

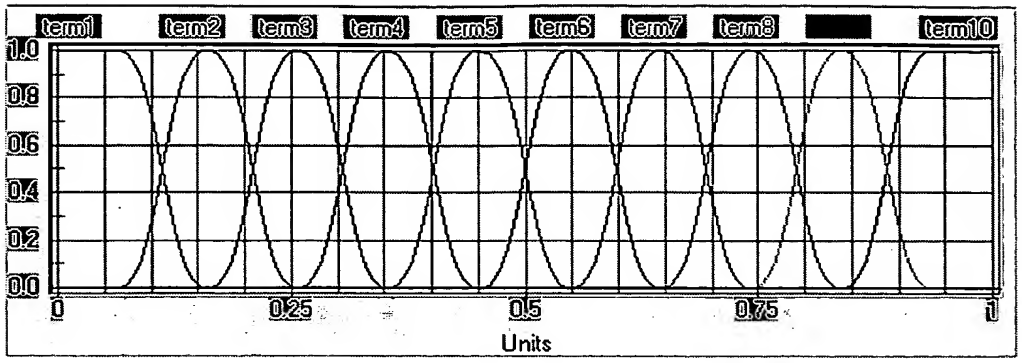


Figure 7: MBF of "IREGCUOP1"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 8: Definition Points of MBF "IREGCUOP1"

.7 Output Variable "IREGCUOP2"

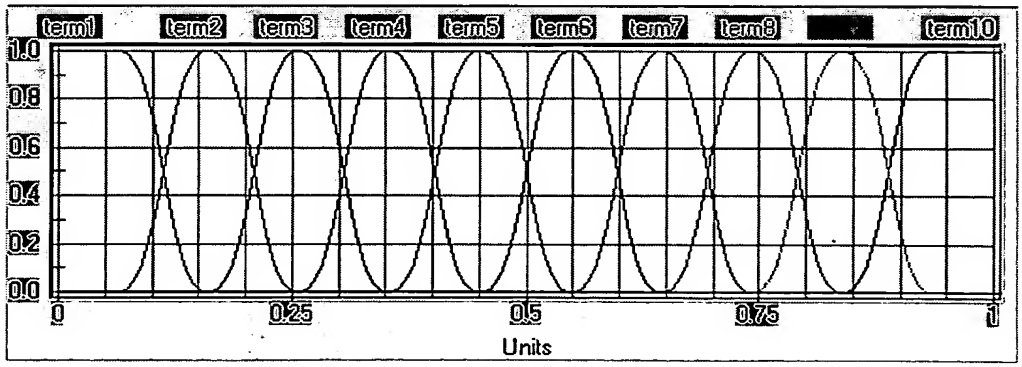


Figure 8: MBF of "IREGCUOP2"

Term Name	Shape/Par.	Definiti n P ints (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 9: Definition Points of MBF "IREGCUOP2"

.8 Output Variable "IREGCUOP3"

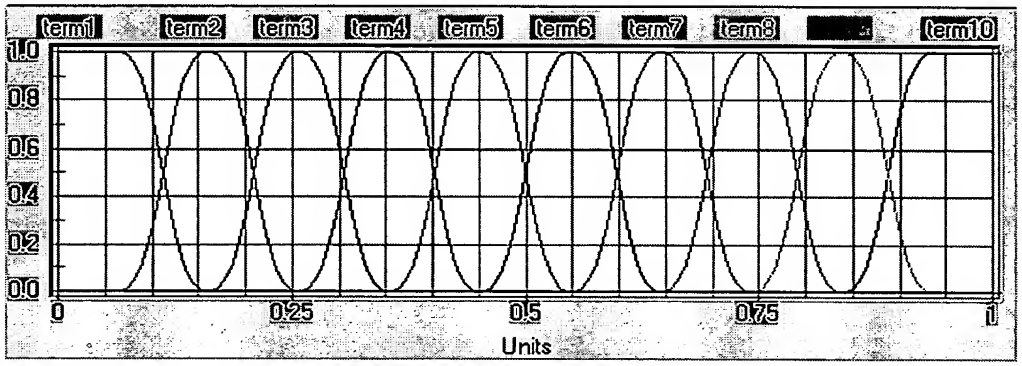


Figure 9: MBF of "IREGCUOP3"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)

Term Name	Shape/Par.	Definiti n Points (x, y)		
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 10: Definition Points of MBF "IREGCUOP3"

.9 Output Variable "IREGCUOP4"

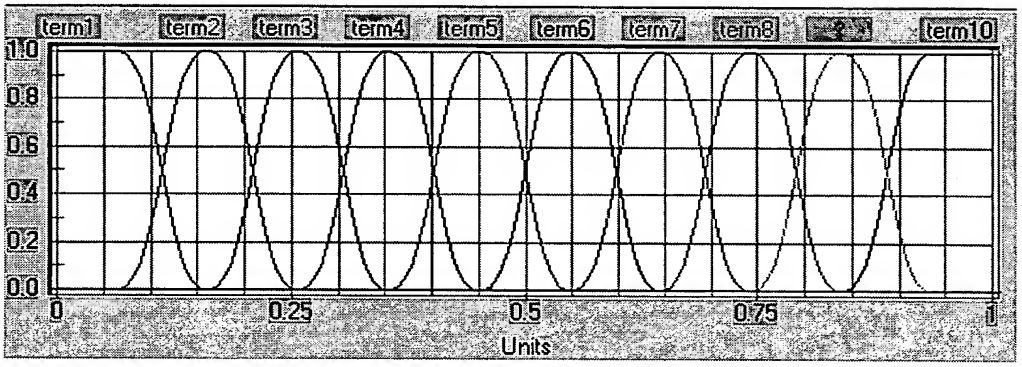


Figure 10: MBF of "IREGCUOP4"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 11: Definition Points of MBF "IREGCUOP4"

.4 Rul Blocks

The rule blocks contain the control strategy of a fuzzy logic system. Each rule block confines all rules for the same context. A context is defined by the same input and output variables of the rules.

The rules' 'if' part describes the situation, for which the rules are designed. The 'then' part describes the response of the fuzzy system in this situation. The degree of support (DoS) is used to weigh each rule according to its importance.

The processing of the rules starts with calculating the 'if' part. The operator type of the rule block determines which method is used. The operator types MIN-MAX, MIN-AVG and GAMMA are available. The characteristic of each operator type is influenced by an additional parameter.

For example:

MIN-MAX, parameter value 0	=	Minimum Operator (MIN)
MIN-MAX, parameter value 1	=	Maximum Operator (MAX)
GAMMA, parameter value 0	=	Product Operator (PROD)

The minimum operator is a generalization of the Boolean 'and'; the maximum operator is a generalization of the Boolean 'or'.

The fuzzy composition eventually combines the different rules to one conclusion. If the BSUM method is used all firing rules are evaluated, if the MAX method is used only the dominant rules are evaluated.

.1 Rule Block "RB1"

IRECU Engine 1

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	50

	IF	THEN
CACUCAGE	**CACUOCCC**	**DoS IREGCUOP1**
term1	very low	
term1	low	
term1	medium	
term1	high	
term1	very high	

	IF	THEN
term2	very low	
term2	low	
term2	medium	
term2	high	
term2	very high	
term3	very low	
term3	low	
term3	medium	
term3	high	
term3	very high	
term4	very low	
term4	low	
term4	medium	
term4	high	
term4	very high	
term5	very low	
term5	low	
term5	medium	
term5	high	
term5	very high	
term6	very low	
term6	low	
term6	medium	
term6	high	
term6	very high	
term7	very low	
term7	low	
term7	medium	
term7	high	
term7	very high	
term8	very low	
term8	low	
term8	medium	
term8	high	
term8	very high	
term9	very low	
term9	low	
term9	medium	
term9	high	
term9	very high	
term10	very low	
term10	low	
term10	medium	
term10	high	
term10	very high	

Table 12: Rules of the Rule Block "RB1"

.2 Rule Bl ck "RB2"

IRECU Engine 2

Parameter

Aggregation: GAMMA

Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN	
CACUSARY	**IREGCUOP1**	**DoS**	**IREGCUOP2**
term1	term1		
term1	term2		
term1	term3		
term1	term4		
term1	term5		
term1	term6		
term1	term7		
term1	term8		
term1	term9		
term1	term10		
term2	term1		
term2	term2		
term2	term3		
term2	term4		
term2	term5		
term2	term6		
term2	term7		
term2	term8		
term2	term9		
term2	term10		
term3	term1		
term3	term2		
term3	term3		
term3	term4		
term3	term5		
term3	term6		
term3	term7		
term3	term8		
term3	term9		
term3	term10		
term4	term1		
term4	term2		
term4	term3		
term4	term4		
term4	term5		
term4	term6		
term4	term7		
term4	term8		
term4	term9		
term4	term10		
term5	term1		
term5	term2		
term5	term3		
term5	term4		
term5	term5		
term5	term6		
term5	term7		
term5	term8		
term5	term9		

	IF	THEN
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 13: Rules of the Rule Block "RB2"

.3 Rul BI ck "RB3"

IRECU Engine 3

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN
CACUCLMT	**IREGCUOP2**	**DoS IREGCUOP3**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	

	IF	THEN
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 14: Rules of the Rule Block "RB3"

.4 Rule Bl ck "RB4"

IRECU Engine 4

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN
EGPRCTCO	**IREGCUOP3**	**DoS IREGCUOP4**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	

	IF	THEN
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	

	IF	THEN
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 15: Rules of the Rule Block "RB4"

1 Gen ral Information

Author:	Youngthink A.I. Labs
Created:	18 Apr 2001
Print Date:	27 Aug 2003

Edition

System Name:	Intelligent Decision Support System
Edition Name:	IRE-IDSS, Intelligent Rule-base Engine Java Edition
Genetic Module:	Genetic add-on Module installed
Neuro Module:	NeuroFuzzy add-on Module installed
Time-Series Module:	Time-Series add-on Module installed

.1 List of Abbreviations

Input Variables	
CABLMKBR	Balance / Credit Rate (0 ~ 10)
CABLMKCR	Current / Credit Rate (0 ~ 10)
CABLMKPR	Payment / Credit Rate (0 ~ 10)
EGPRMKCO	IRE Marketing Behavior Parameter (0 ~ 1)
Output Variables	
IREGMKOP1	IRE Statement Engine Output 1 (0 ~ 1)
IREGMKOP2	IRE Statement Engine Output 2 (0 ~ 1)
IREGMKOP3	IRE Statement Engine Output 3 (0 ~ 1)
Compute MBF	Compute Membership Function (Fuzzification Method)
CoM	Center of Maximum (Defuzzification Method)
BSUM	Bounded Sum Fuzzy Operator for Result Aggregation
MIN	Fuzzy Operator for AND Aggregation
MAX	Fuzzy Operator for OR Aggregation
GAMMA	Compensatory Operator for Aggregation
PROD	Fuzzy Operator for Composition
LV	Linguistic Variable
MBF	Membership Function
RB	Rule Block

2 Intelligent Decision Support Syst m

.1 Project Description

Edition Name: IRE-IDSS, Intelligent Rule-base Engine Java Edition
System Name: Intelligent Decision Support System

Input Variables	4
Output Variables	3
Intermediate Variables	0
Rule Blocks	3
Rules	300
Membership Functions	70

Table 1: Project Statistics

.2 System Structure

The system structure identifies the fuzzy logic inference flow from the input variables to the output variables. The fuzzification in the input interfaces translates analog inputs into fuzzy values. The fuzzy inference takes place in rule blocks which contain the linguistic control rules. The output of these rule blocks are linguistic variables. The defuzzification in the output interfaces translates them into analog variables.

The following figure shows the whole structure of this fuzzy system including input interfaces, rule blocks and output interfaces. The connecting lines symbolize the data flow.

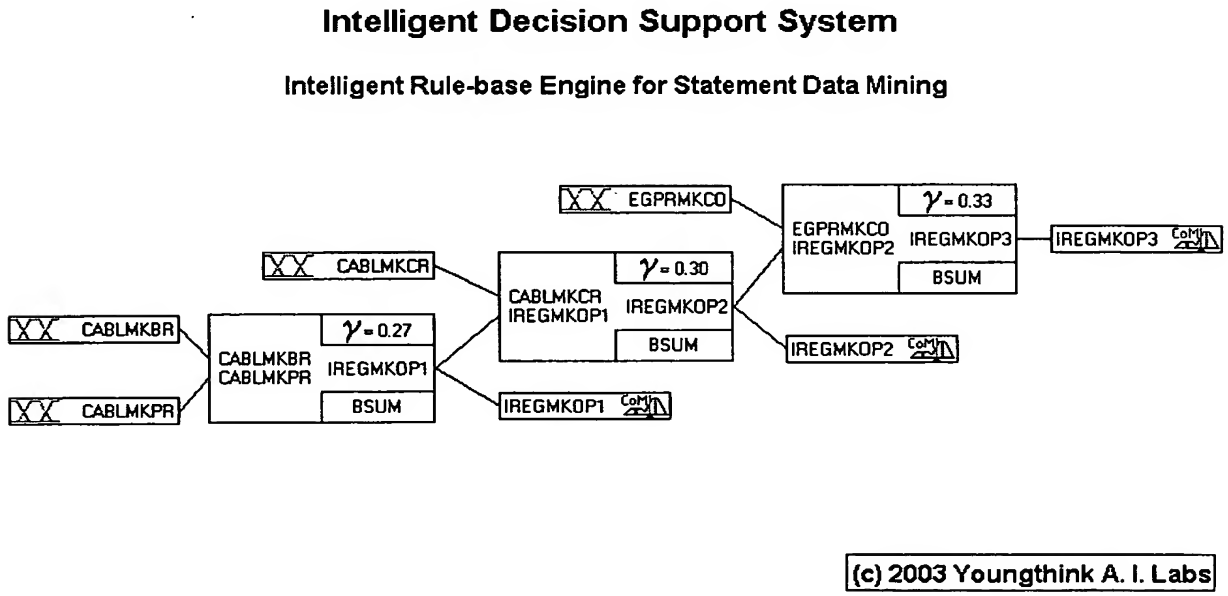


Figure 1: Structure of the Fuzzy Logic System

.3 Linguistic Variabl s

This chapter contains the definition of all linguistic variables and of all membership functions.
Linguistic variables are used to translate real values into linguistic values. The possible values of a linguistic variable are not numbers but so called 'linguistic terms'.

The following table lists all linguistic variables of the system as well as the respective fuzzification or defuzzification method. Also the properties of all base variables and the term names are listed.

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
1	CABLMKBR		Units	0	10	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
2	CABLMKCR		Units	0	10	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
3	CABLMKPR		Units	0	10	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
4	EGPRMKCO		Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
5	IREGMKOP1		Units	0	1	0	term1 term2

#	Variable Name	Type	Unit	Min	Max	Default	T rm Names
							term3
							term4
							term5
							term6
							term7
							term8
							term9
							term10
6	IREGMKOP2	CoM	Units	0	1	0	term1
							term2
							term3
							term4
							term5
							term6
							term7
							term8
							term9
							term10
7	IREGMKOP3	CoM	Units	0	1	0	term1
							term2
							term3
							term4
							term5
							term6
							term7
							term8
							term9
							term10

Table 2: Linguistic Variables

Compute MBF
Look up MBF
Categorical Variables
Display
Fuzzy Input/Fuzzy Output

Center of Maximum (CoM)
Mean of Maximum (MoM)
Center of Area (CoA)
Hyper CoM
Force

The default value of an output variable is used if no rule is firing for this variable. Different methods can be used for the defuzzification, resulting either into the 'most plausible result' or the 'best compromise'.

The 'best compromise' is produced by the methods:
CoM (Center of Maximum)
CoA (Center of Area)
CoA BSUM, a version especially for efficient VLSI implementations

The 'most plausible result is produced by the methods:
MoM (Mean of Maximum)
MoM BSUM, a version especially for efficient VLSI implementations

.1 Input Variable "CABLMKBR"

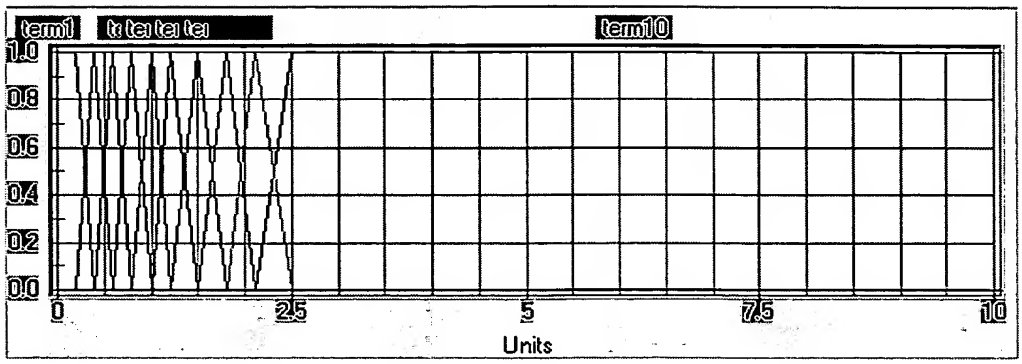


Figure 2: MBF of "CABLMKBR"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(0.2, 1)	(0.4, 0)
		(10, 0)		
term2	linear	(0, 0)	(0.2, 0)	(0.4, 1)
		(0.6, 0)	(10, 0)	
term3	linear	(0, 0)	(0.4, 0)	(0.6, 1)
		(0.8, 0)	(10, 0)	
term4	linear	(0, 0)	(0.6, 0)	(0.8, 1)
		(1, 0)	(10, 0)	
term5	linear	(0, 0)	(0.8, 0)	(1, 1)
		(1.2, 0)	(10, 0)	
term6	linear	(0, 0)	(1, 0)	(1.2, 1)
		(1.5, 0)	(10, 0)	
term7	linear	(0, 0)	(1.2, 0)	(1.5, 1)
		(1.8, 0)	(10, 0)	
term8	linear	(0, 0)	(1.5, 0)	(1.8, 1)
		(2.1, 0)	(10, 0)	
term9	linear	(0, 0)	(1.8, 0)	(2.1, 1)
		(2.5, 0)	(10, 0)	
term10	linear	(0, 0)	(2.1, 0)	(2.5, 1)
		(10, 1)		

Table 3: Definition Points of MBF "CABLMKBR"

.2 Input Variable "CABLMKCR"

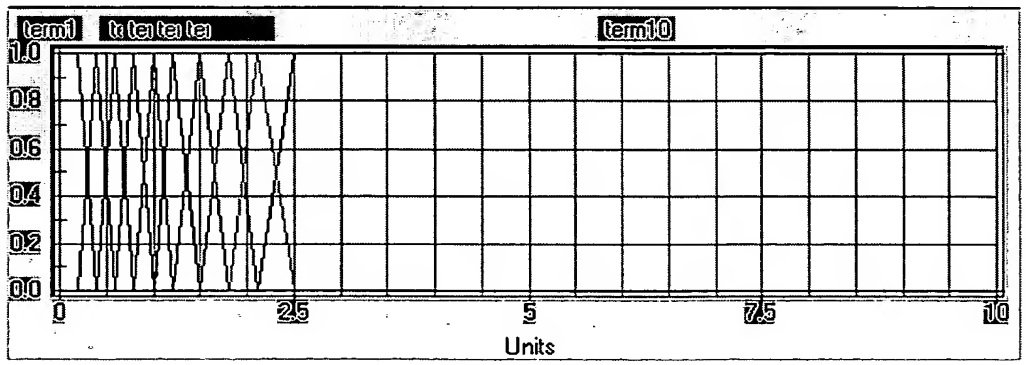


Figure 3: MBF of "CABLMKCR"

Term Name	Shape/Par.	Definition P ints (x, y)		
term1	linear	(0, 1)	(0.2, 1)	(0.4, 0)
		(10, 0)		
term2	linear	(0, 0)	(0.2, 0)	(0.4, 1)
		(0.6, 0)	(10, 0)	
term3	linear	(0, 0)	(0.4, 0)	(0.6, 1)
		(0.8, 0)	(10, 0)	
term4	linear	(0, 0)	(0.6, 0)	(0.8, 1)
		(1, 0)	(10, 0)	
term5	linear	(0, 0)	(0.8, 0)	(1, 1)
		(1.2, 0)	(10, 0)	
term6	linear	(0, 0)	(1, 0)	(1.2, 1)
		(1.5, 0)	(10, 0)	
term7	linear	(0, 0)	(1.2, 0)	(1.5, 1)
		(1.8, 0)	(10, 0)	
term8	linear	(0, 0)	(1.5, 0)	(1.8, 1)
		(2.1, 0)	(10, 0)	
term9	linear	(0, 0)	(1.8, 0)	(2.1, 1)
		(2.5, 0)	(10, 0)	
term10	linear	(0, 0)	(2.1, 0)	(2.5, 1)
		(10, 1)		

Table 4: Definition Points of MBF "CABLMKCR"

.3 Input Variable "CABLMKPR"

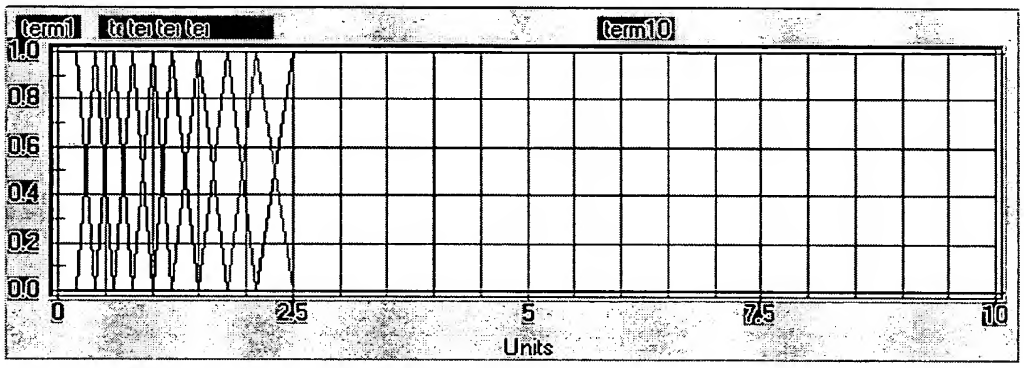


Figure 4: MBF of "CABLMKPR"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(0.2, 1)	(0.4, 0)
		(10, 0)		
term2	linear	(0, 0)	(0.2, 0)	(0.4, 1)
		(0.6, 0)	(10, 0)	
term3	linear	(0, 0)	(0.4, 0)	(0.6, 1)
		(0.8, 0)	(10, 0)	
term4	linear	(0, 0)	(0.6, 0)	(0.8, 1)
		(1, 0)	(10, 0)	
term5	linear	(0, 0)	(0.8, 0)	(1, 1)

Term Name	Shape/Par.	Definiti n Points (x, y)		
		(1.2, 0)	(10, 0)	
term6	linear	(0, 0)	(1, 0)	(1.2, 1)
		(1.5, 0)	(10, 0)	
term7	linear	(0, 0)	(1.2, 0)	(1.5, 1)
		(1.8, 0)	(10, 0)	
term8	linear	(0, 0)	(1.5, 0)	(1.8, 1)
		(2.1, 0)	(10, 0)	
term9	linear	(0, 0)	(1.8, 0)	(2.1, 1)
		(2.5, 0)	(10, 0)	
term10	linear	(0, 0)	(2.1, 0)	(2.5, 1)
		(10, 1)		

Table 5: Definition Points of MBF "CABLMKPR"

.4 Input Variable "EGPRMKCO"

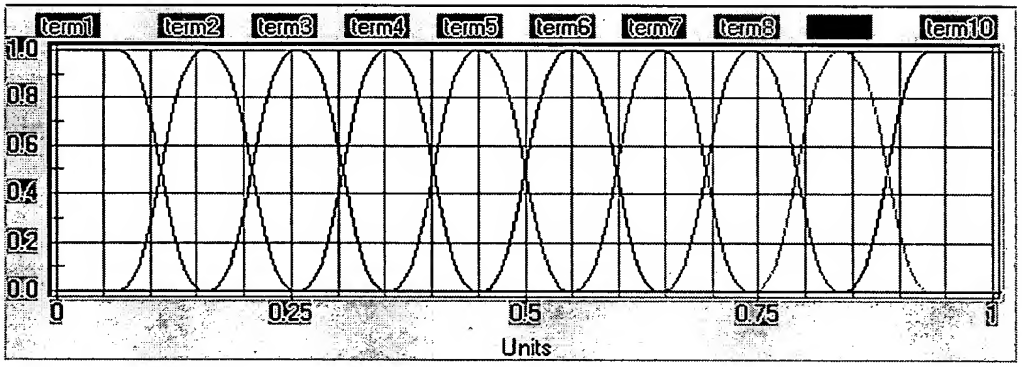


Figure 5: MBF of "EGPRMKCO"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 6: Definition Points of MBF "EGPRMKCO"

.5 Output Variable "IREGMKOP1"

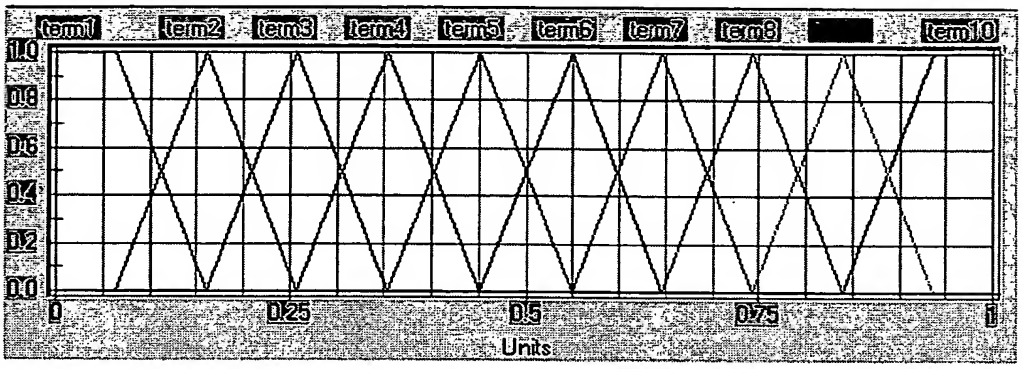


Figure 6: MBF of "IREGMKOP1"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	linear	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	linear	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	linear	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	linear	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	linear	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	linear	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	linear	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	linear	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	linear	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	linear	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 7: Definition Points of MBF "IREGMKOP1"

.6 Output Variable "IREGMKOP2"

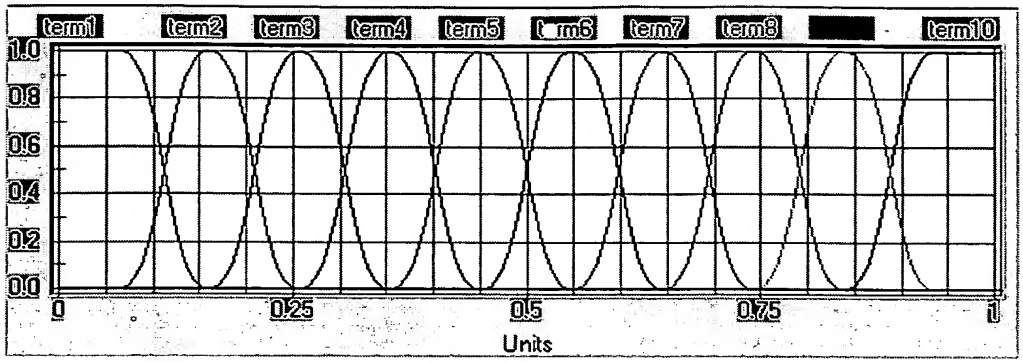


Figure 7: MBF of "IREGMKOP2"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 8: Definition Points of MBF "IREGMKOP2"

.7 Output Variable "IREGMKOP3"

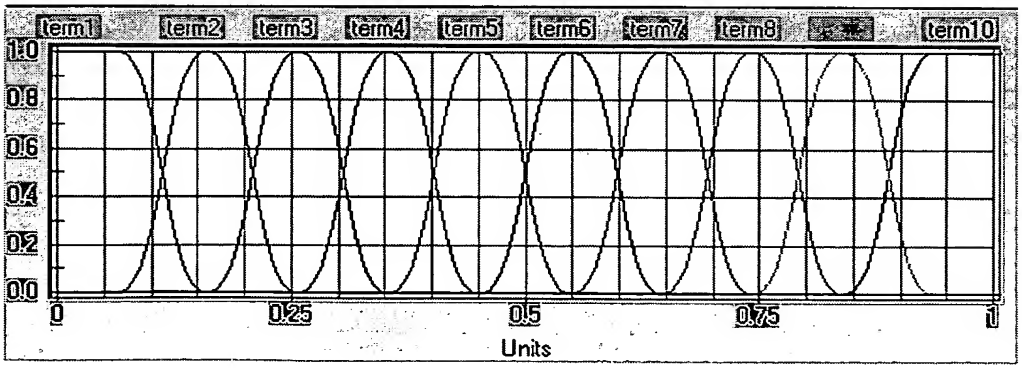


Figure 8: MBF of "IREGMKOP3"

Term Name	Shape/Par.	Definiti n P ints (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 9: Definition Points of MBF "IREGMKOP3"

.4 Rule Blocks

The rule blocks contain the control strategy of a fuzzy logic system. Each rule block confines all rules for the same context. A context is defined by the same input and output variables of the rules.

The rules' 'if' part describes the situation, for which the rules are designed. The 'then' part describes the response of the fuzzy system in this situation. The degree of support (DoS) is used to weigh each rule according to its importance.

The processing of the rules starts with calculating the 'if' part. The operator type of the rule block determines which method is used. The operator types MIN-MAX, MIN-AVG and GAMMA are available. The characteristic of each operator type is influenced by an additional parameter.

For example:

MIN-MAX, parameter value 0 = Minimum Operator (MIN)
MIN-MAX, parameter value 1 = Maximum Operator (MAX)
GAMMA, parameter value 0 = Product Operator (PROD)

The minimum operator is a generalization of the Boolean 'and'; the maximum operator is a generalization of the Boolean 'or'.

The fuzzy composition eventually combines the different rules to one conclusion. If the BSUM method is used all firing rules are evaluated, if the MAX method is used only the dominant rules are evaluated.

.1 Rule Block "RB1"

IREMK Engine 1

Parameter

Aggregation:	GAMMA
Parameter:	0.27
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN	
CABLMKBR	**CABLMKPR**	**DoS**	**IREGMKOP1**
term1	term1		
term1	term2		
term1	term3		
term1	term4		
term1	term5		
term1	term6		
term1	term7		
term1	term8		
term1	term9		
term1	term10		
term2	term1		
term2	term2		
term2	term3		
term2	term4		
term2	term5		
term2	term6		
term2	term7		
term2	term8		
term2	term9		
term2	term10		
term3	term1		
term3	term2		
term3	term3		
term3	term4		
term3	term5		
term3	term6		
term3	term7		
term3	term8		
term3	term9		
term3	term10		
term4	term1		
term4	term2		
term4	term3		
term4	term4		
term4	term5		
term4	term6		
term4	term7		

	IF	THEN
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	

	IF	THEN
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 10: Rules of the Rule Block "RB1"

.2 Rule Block "RB2"

IREMK Engine 2

Parameter

Aggregation:	GAMMA
Parameter:	0.30
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

	IF	THEN
CABLMKCR	**IREGMKOP1**	**DoS IREGMKOP2**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	

	IF	THEN
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	

	IF	THEN
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 11: Rules of the Rule Block "RB2"

.3 Rule Block "RB3"

IREMK Engine 3

Parameter

Aggregation:	GAMMA
Parameter:	0.33
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

	IF	THEN
EGPRMKCO	**IREGMKOP2**	**DoS IREGMKOP3**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	

	IF	THEN
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	

	IF	THEN
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 12: Rules of the Rule Block "RB3"

1 General Information

Author:	Youngthink A.I. Labs
Created:	18 Apr 2001
Print Date:	27 Aug 2003

Edition

System Name:	Intelligent Decision Support System
Edition Name:	IRE-IDSS, Intelligent Rule-base Engine Java Edition
Genetic Module:	Genetic add-on Module installed
Neuro Module:	NeuroFuzzy add-on Module installed
Time-Series Module:	Time-Series add-on Module installed

.1 List of Abbreviations

Input Variables	
IREGCPCT	IRECP Engine Output 1 (Current Time 0 ~ 1)
IREGCPFT	IRECP Engine Output 1 (Future Time 0 ~ 1)
IREGCPPT	IRECP Engine Output 1 (Past Time 0 ~ 1)
Output Variables	
IREGTSOP1	IRETS Engine Output 1 (Past and Current Parameter 0 ~ 1)
IREGTSOP2	IRETS Engine Output 2 (Current and Future Parameter 0 ~ 1)
IREGTSOP3	IRETS Engine Output 3 (Forecasting Parameter 0 ~ 1)
Compute MBF	Compute Membership Function (Fuzzification Method)
CoM	Center of Maximum (Defuzzification Method)
BSUM	Bounded Sum Fuzzy Operator for Result Aggregation
MIN	Fuzzy Operator for AND Aggregation
MAX	Fuzzy Operator for OR Aggregation
GAMMA	Compensatory Operator for Aggregation
PROD	Fuzzy Operator for Composition
LV	Linguistic Variable
MBF	Membership Function
RB	Rule Block

2 Intelligent Decision Support System

.1 Project Description

Edition Name: IRE-IDSS, Intelligent Rule-base Engine Java Edition
System Name: Intelligent Decision Support System

Input Variables	3
Output Variables	3
Intermediate Variables	0
Rule Blocks	3
Rules	300
Membership Functions	60

Table 1: Project Statistics

.2 System Structure

The system structure identifies the fuzzy logic inference flow from the input variables to the output variables. The fuzzification in the input interfaces translates analog inputs into fuzzy values. The fuzzy inference takes place in rule blocks which contain the linguistic control rules. The output of these rule blocks are linguistic variables. The defuzzification in the output interfaces translates them into analog variables.

The following figure shows the whole structure of this fuzzy system including input interfaces, rule blocks and output interfaces. The connecting lines symbolize the data flow.

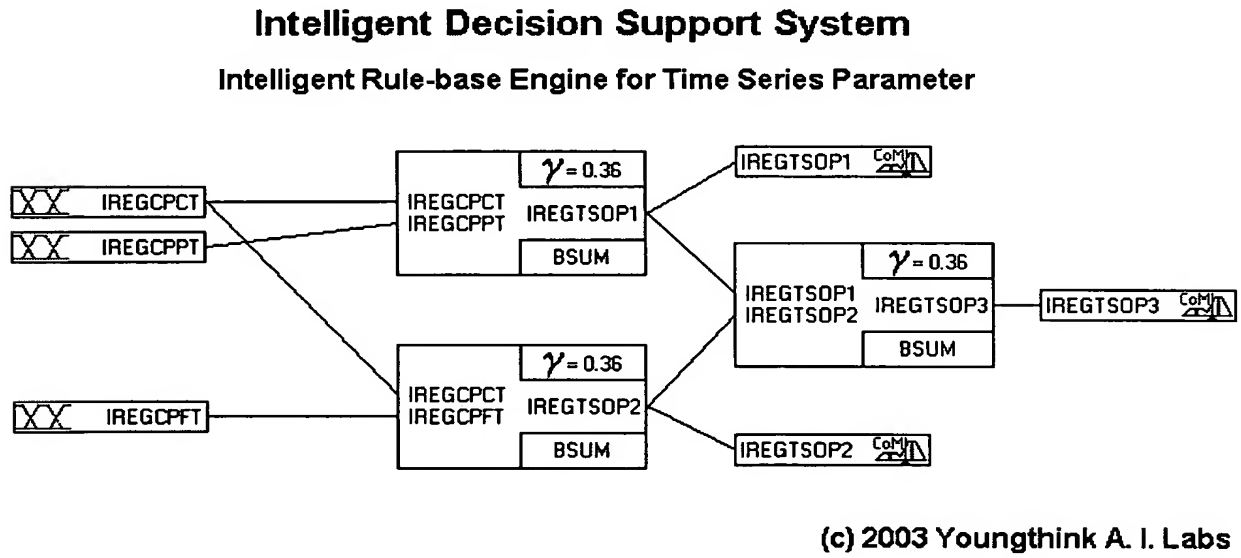


Figure 1: Structure of the Fuzzy Logic System

.3 Linguistic Variabl s

This chapter contains the definition of all linguistic variables and of all membership functions.
Linguistic variables are used to translate real values into linguistic values. The possible values of a linguistic variable are not numbers but so called 'linguistic terms'.

The following table lists all linguistic variables of the system as well as the respective fuzzification or defuzzification method. Also the properties of all base variables and the term names are listed.

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
1	IREGCPCT	XX	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
2	IREGCPFT	XX	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
3	IREGCPPT	XX	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
4	IREGTSOP1	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10
5	IREGTSOP2	CoM	Units	0	1	0	term1 term2

#	Variable Name	Type	Unit	Min	Max	Default	Term Names
							term3 term4 term5 term6 term7 term8 term9 term10
6	IREGTSOP3	CoM	Units	0	1	0	term1 term2 term3 term4 term5 term6 term7 term8 term9 term10

Table 2: Linguistic Variables


Compute MBF
Look up MBF
Categorical Variables
Display
Fuzzy Input/Fuzzy Output


Center of Maximum (CoM)
Mean of Maximum (MoM)
Center of Area (CoA)
Hyper CoM
Force

The default value of an output variable is used if no rule is firing for this variable. Different methods can be used for the defuzzification, resulting either into the 'most plausible result' or the 'best compromise'.

The 'best compromise' is produced by the methods:

CoM (Center of Maximum)
CoA (Center of Area)
CoA BSUM, a version especially for efficient VLSI implementations

The 'most plausible result is produced by the methods:

MoM (Mean of Maximum)
MoM BSUM, a version especially for efficient VLSI implementations

.1 Input Variable "IREGCPCT"

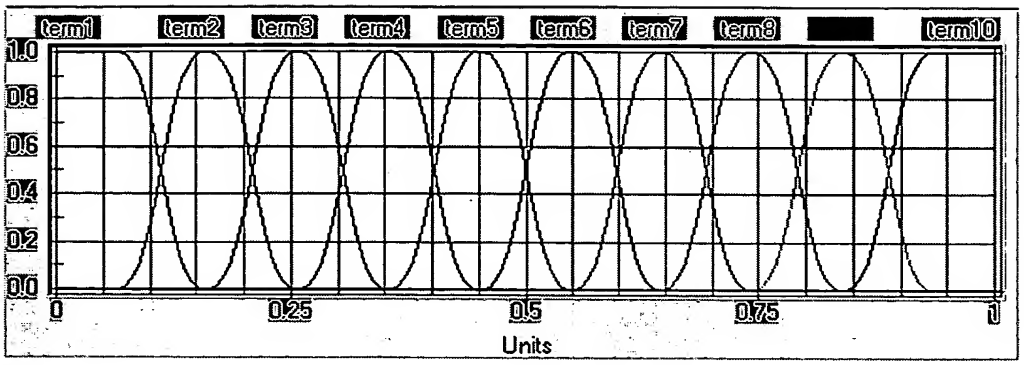


Figure 2: MBF of "IREGCPCT"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 3: Definition Points of MBF "IREGCPCT"

.2 Input Variable "IREGCPFT"

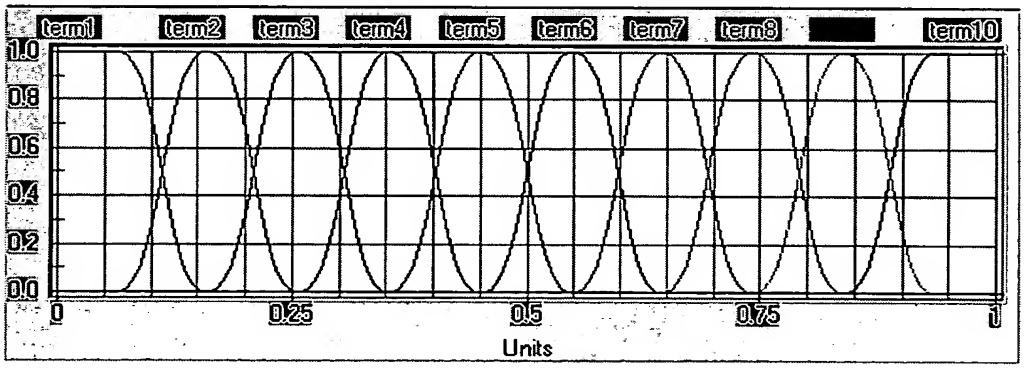


Figure 3: MBF of "IREGCPFT"

Term Nam	Shape/Par.	Definiti n Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 4: Definition Points of MBF "IREGCPFT"

.3 Input Variable "IREGCPPT"

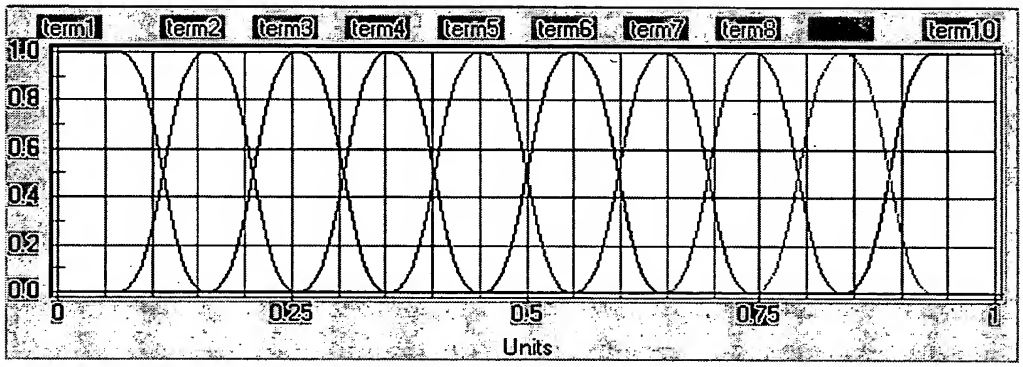


Figure 4: MBF of "IREGCPPT"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.06364, 1)	(0.1606, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.06364, 0)	(0.1606, 1)
		(0.25758, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.1606, 0)	(0.25758, 1)
		(0.35454, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.25758, 0)	(0.35454, 1)
		(0.45152, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.35454, 0)	(0.45152, 1)

Term Name	Shape/Par.	Definiti n Points (x, y)		
		(0.54848, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.45152, 0)	(0.54848, 1)
		(0.64544, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.54848, 0)	(0.64544, 1)
		(0.74242, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.64544, 0)	(0.74242, 1)
		(0.83938, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.74242, 0)	(0.83938, 1)
		(0.93636, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.83938, 0)	(0.93636, 1)
		(1, 1)		

Table 5: Definition Points of MBF "IREGCPPT"

.4 Output Variable "IREGTSOP1"

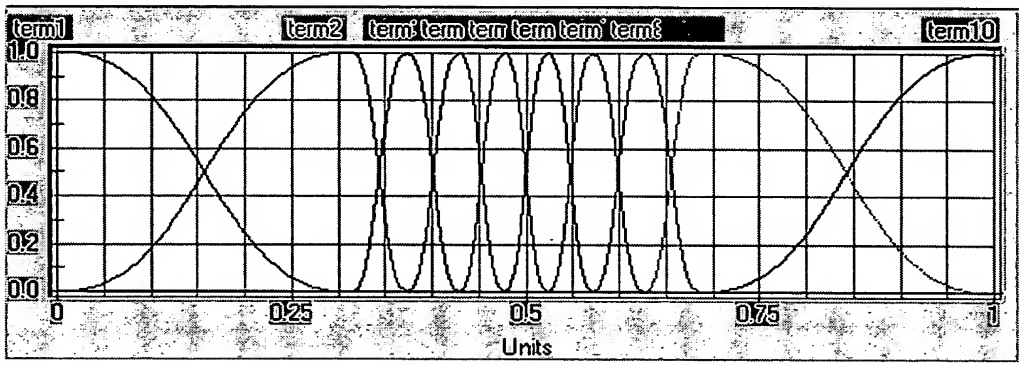


Figure 5: MBF of "IREGTSOP1"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.3153, 0)	(1, 0)
term2	S-Shape/0.50	(0, 0)	(0.3153, 1)	(0.37466, 0)
		(1, 0)		
term3	S-Shape/0.50	(0, 0)	(0.3153, 0)	(0.37466, 1)
		(0.42862, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.37466, 0)	(0.42862, 1)
		(0.47768, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.42862, 0)	(0.47768, 1)
		(0.5223, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.47768, 0)	(0.5223, 1)
		(0.57136, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.5223, 0)	(0.57136, 1)
		(0.62532, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.57136, 0)	(0.62532, 1)
		(0.68468, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.62532, 0)	(0.68468, 1)
		(1, 0)		
term10	S-Shape/0.50	(0, 0)	(0.68468, 0)	(1, 1)

Table 6: Definition Points of MBF "IREGTSOP1"

.5 Output Variable "IREGTSOP2"

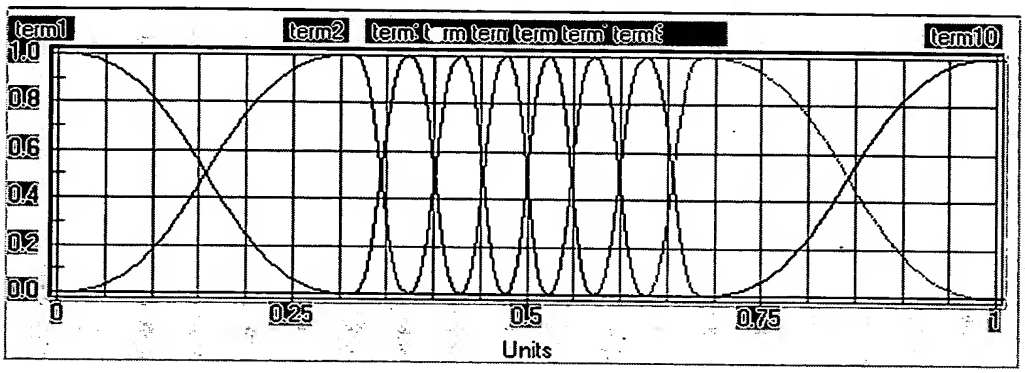


Figure 6: MBF of "IREGTSOP2"

Term Name	Shape/Par.	Definition Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.3153, 0)	(1, 0)
term2	S-Shape/0.50	(0, 0)	(0.3153, 1)	(0.37466, 0)
		(1, 0)		
term3	S-Shape/0.50	(0, 0)	(0.3153, 0)	(0.37466, 1)
		(0.42862, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.37466, 0)	(0.42862, 1)
		(0.47768, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.42862, 0)	(0.47768, 1)
		(0.5223, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.47768, 0)	(0.5223, 1)
		(0.57136, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.5223, 0)	(0.57136, 1)
		(0.62532, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.57136, 0)	(0.62532, 1)
		(0.68468, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.62532, 0)	(0.68468, 1)
		(1, 0)		
term10	S-Shape/0.50	(0, 0)	(0.68468, 0)	(1, 1)

Table 7: Definition Points of MBF "IREGTSOP2"

.6 Output Variable "IREGTSOP3"

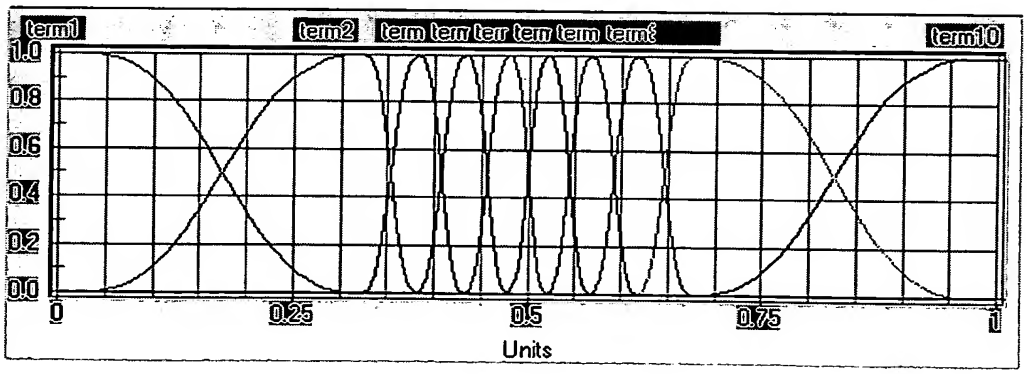


Figure 7: MBF of "IREGTSOP3"

Term Name	Shape/Par.	Definiti n Points (x, y)		
term1	S-Shape/0.50	(0, 1)	(0.0218, 1)	(0.32518, 0)
		(1, 0)		
term2	S-Shape/0.50	(0, 0)	(0.0218, 0)	(0.32518, 1)
		(0.38258, 0)	(1, 0)	
term3	S-Shape/0.50	(0, 0)	(0.32518, 0)	(0.38258, 1)
		(0.43382, 0)	(1, 0)	
term4	S-Shape/0.50	(0, 0)	(0.38258, 0)	(0.43382, 1)
		(0.47956, 0)	(1, 0)	
term5	S-Shape/0.50	(0, 0)	(0.43382, 0)	(0.47956, 1)
		(0.52042, 0)	(1, 0)	
term6	S-Shape/0.50	(0, 0)	(0.47956, 0)	(0.52042, 1)
		(0.56618, 0)	(1, 0)	
term7	S-Shape/0.50	(0, 0)	(0.52042, 0)	(0.56618, 1)
		(0.61742, 0)	(1, 0)	
term8	S-Shape/0.50	(0, 0)	(0.56618, 0)	(0.61742, 1)
		(0.6748, 0)	(1, 0)	
term9	S-Shape/0.50	(0, 0)	(0.61742, 0)	(0.6748, 1)
		(0.97818, 0)	(1, 0)	
term10	S-Shape/0.50	(0, 0)	(0.6748, 0)	(0.97818, 1)
		(1, 1)		

Table 8: Definition Points of MBF "IREGTSOP3"

.4 Rule Blocks

The rule blocks contain the control strategy of a fuzzy logic system. Each rule block confines all rules for the same context. A context is defined by the same input and output variables of the rules.

The rules' 'if' part describes the situation, for which the rules are designed. The 'then' part describes the response of the fuzzy system in this situation. The degree of support (DoS) is used to weigh each rule according to its importance.

The processing of the rules starts with calculating the 'if' part. The operator type of the rule block determines which method is used. The operator types MIN-MAX, MIN-AVG and GAMMA are available. The characteristic of each operator type is influenced by an additional parameter.

For example:

MIN-MAX, parameter value 0 = Minimum Operator (MIN)
MIN-MAX, parameter value 1 = Maximum Operator (MAX)
GAMMA, parameter value 0 = Product Operator (PROD)

The minimum operator is a generalization of the Boolean 'and'; the maximum operator is a generalization of the Boolean 'or'.

The fuzzy composition eventually combines the different rules to one conclusion. If the BSUM method is used all firing rules are evaluated, if the MAX method is used only the dominant rules are evaluated.

.1 Rule Block "RB1"

IRETS Engine 1

Parameter

Aggregation:	GAMMA
Parameter:	0.36
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN
IREGCPCT	IREGCPPT	DoS IREGTSOP1
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	

	IF	THEN
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	

IF	THEN
term10	term5
term10	term6
term10	term7
term10	term8
term10	term9
term10	term10

Table 9: Rules of the Rule Block "RB1"

.2 Rule Block "RB2"

IRETS Engine 2

Parameter

Aggregation:	GAMMA
Parameter:	0.36
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

IF		THEN
IREGCPCT	**IREGCPFT**	**DoS IREGTSOP2**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	

	IF	THEN
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	
term9	term1	
term9	term2	
term9	term3	
term9	term4	
term9	term5	
term9	term6	
term9	term7	

	IF	THEN
term9	term8	
term9	term9	
term9	term10	
term10	term1	
term10	term2	
term10	term3	
term10	term4	
term10	term5	
term10	term6	
term10	term7	
term10	term8	
term10	term9	
term10	term10	

Table 10: Rules of the Rule Block "RB2"

.3 Rule Block "RB3"

IRETS Engine 3

Parameter

Aggregation:	GAMMA
Parameter:	0.36
Result Aggregation:	BSUM
Number of Inputs:	2
Number of Outputs:	1
Number of Rules:	100

	IF	THEN
IREGTSOP1	**IREGTSOP2**	**DoS IREGTSOP3**
term1	term1	
term1	term2	
term1	term3	
term1	term4	
term1	term5	
term1	term6	
term1	term7	
term1	term8	
term1	term9	
term1	term10	
term2	term1	
term2	term2	
term2	term3	
term2	term4	
term2	term5	
term2	term6	
term2	term7	
term2	term8	
term2	term9	
term2	term10	
term3	term1	
term3	term2	
term3	term3	

	IF	THEN
term3	term4	
term3	term5	
term3	term6	
term3	term7	
term3	term8	
term3	term9	
term3	term10	
term4	term1	
term4	term2	
term4	term3	
term4	term4	
term4	term5	
term4	term6	
term4	term7	
term4	term8	
term4	term9	
term4	term10	
term5	term1	
term5	term2	
term5	term3	
term5	term4	
term5	term5	
term5	term6	
term5	term7	
term5	term8	
term5	term9	
term5	term10	
term6	term1	
term6	term2	
term6	term3	
term6	term4	
term6	term5	
term6	term6	
term6	term7	
term6	term8	
term6	term9	
term6	term10	
term7	term1	
term7	term2	
term7	term3	
term7	term4	
term7	term5	
term7	term6	
term7	term7	
term7	term8	
term7	term9	
term7	term10	
term8	term1	
term8	term2	
term8	term3	
term8	term4	
term8	term5	
term8	term6	
term8	term7	
term8	term8	
term8	term9	
term8	term10	

Intelligent Decision Support System

IDSS for Dynamic Credit Scoring

I. Abstract

Aim

- To select excellent clients regularly and to automatically increase the credit line so that old clients can be secured and further to raise the utility rate.
- To sieve out potential clients of risks regularly and to automatically decrease the credit line so that the risks can be controlled effectively to reduce bad debts.
- The results of analysis can be references for credit scoring.

- Sampling
  - The number of clients in our data bank: 10 percent of three million clients (i.e.300 thousand people)
  - Duration of data: from January, 2002 to December, 2002.
  - Forecast duration: from January, 2003 to June, 2003.

2. Technique

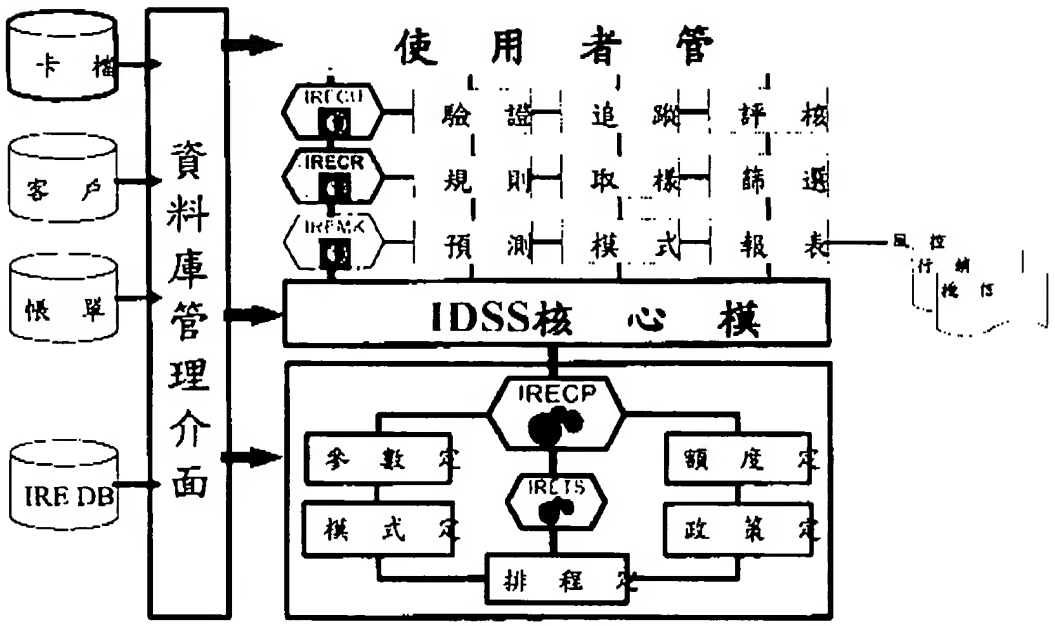
- To provide an effective decision support system for banks to promote their business of credit cards.
- We make IDSS and IRE the cores. IRE is authorized by its inventor E-chain Cheng, Youngthink A. I. Labs., belonging to Aimaster Labs. USA, and Fuzzytech Labs. AG.
- It focuses on risk management of credit cards, including examining credit references, pressing for repayment of overdue bills and guarding against bogus cards, and marketing. With the installment of IDSS, decision support can be achieved timely, effectively, and precisely.

- The principle of IRE
  - It is based on historical database.
  - Default Values or User Defined
  - It combines different calculations.
    - Genetic comparison
    - Neuro-Fuzzy
    - Time-Series

It can modulate the relevant parameters and suggest the best parameter. Furthermore, it can learn and revise automatically to improve its accuracy.

- It centers on IRE and combines with IDSS to complete decision support by module calculating after processing Data Mining.

3. Systematic structure



4. List of clients whose credit is raised.

5. The statistics of credit line.

Module	number of people	the credit line before adjustment	Recommended credit line	The credit line after adjustment
B0	20,286	2,385,150,311	288,688,755	2,673,839,066
B1	22,572	2,614,807,983	318,106,044	2,932,914,027
B2	22,092	2,611,620,712	315,139,892	2,926,760,604
B3	17,855	2,175,781,423	262,998,542	2,438,779,965
B4	20,272	2,400,227,500	290,515,404	2,690,742,904
B5	18,864	2,260,363,292	272,730,679	2,533,093,971
B6	20,359	2,397,648,554	291,163,269	2,688,811,823
B7	22,233	2,580,758,667	311,631,537	2,892,390,204
B8	22,630	2,579,940,272	313,839,529	2,893,779,801
B9	21,113	2,467,841,306	299,686,862	2,767,528,168
Total(NT$)	208,276	24,474,140,020	2,964,500,513	27,438,640,533

There are 208,276 people in the list. The total of adjustable credit is 2,964,500,513.

The rate of adjustable credit makes up 69.5 percent of the database.

The average of adjustable credit is 14,233.5.

- The results

  Sources: from January to December, 2002.

  Forecast duration: from January to June, 2003.

  Experiment: August, 2003.

  The results are verified by the staff who work on credit card business in the bank:

  - Those who fit in with the adjustable condition take up 78 percent.
  - Persons whose credit has been raised in the list take up 50 percent.

- Relevant files

  - AI_Patent_IRECP.doc
  - AI_Patent_IRECR.doc
  - AI_Patent_IRECU.doc
  - AI_Patent_IREMK.doc
  - AI_Patent_IRETS.doc